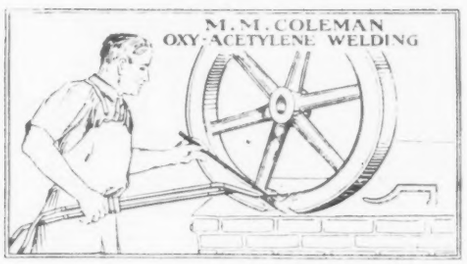
The Welding Engineer

Reg. U. S. Pat. Office

Vol. IV | Chicago 608 S. Dearborn St. | JANUARY, 1919 | $2.00 per year in U. S. $2.50 per year abroad | No. 1



M. M. COLEMAN
OXY-ACETYLENE WELDING

Night Work by Appointment Portable Outfit Always Ready

Experts on Cylinders, Gears, Aluminum, Pipe and Boiler Work

Work Guaranteed

Phone Main 4598 **207 12th St. N. W.**

Washington, D. C., December 28, 1918.

Torchweld Equipment Co.,

Fulton and Carpenter Sts., Chicago, Ill.

Gentlemen:—

I have often thought I ought to write and tell you how well pleased I am with your welding and cutting apparatus. Having been in the welding business for many years working for myself as well as for others, and having used many different makes of apparatus, I feel competent to say that the Torchweld apparatus is the most reliable and gives the best satisfaction of any oxy-acetylene apparatus in the market today. Welding is our specialty. The work we handle in the shop as well as outside work varies from the ordinary small work to the largest welding jobs, and I believe I am justified in saying I have the best equipped and best paying welding shop in this part of the country.

As I also work myself, I have had every opportunity to try out your torches under the most severe conditions. To gain time and save on the cost I do not now bevel large castings. After they are set up and preheated, I melt and blow out the metal at the crack, sometimes pushing out the molten metal with the tip. This I do on metal several inches thick. It has surprised me many times to see that the Torchweld torches will stand so much abuse without the flame going out or flashing back; no other torches that I have tried would begin to stand up under such hard service. They are just as satisfactory on light work. For seam welding on sheet metal a Torchweld torch can't be beaten as the soft flame makes it very easy to produce a neat and even weld.

Another thing I like about your torches is that I can easily increase or decrease the flame with the same tip and still have a neutral flame which is not only very convenient but very essential in order to finish the work properly and turn it out at a low cost. While your torches are unusually light, I have found that they stand up on any class of work, and it is certainly a relief to have a light and well balanced torch when one has to work continuously for hours at a time. One year ago I bought one Torchweld Welding and one Torchweld Cutting Equipment which are still in use; we now have seven and have discarded all other makes as I find your apparatus the cheapest, considering economy in operation and practically no upkeep.

Very truly yours,

M. M. Coleman

Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

Classified Buyers Index, Page 4. Table of Contents, Page 36.

Oxweld

Welding the Icicle

BREAK an icicle some snappy zero morning; thaw the broken ends a little over a candle; then let them freeze together. . . . You have welded the icicle!

That's the way oxwelding works on broken metals.

At high temperature, metals are liquid like water at ordinary temperature. Ordinarily—at the temperature at which you use them—the metals are "frozen" solid. . . . A break occurs; you melt the surfaces of the break with the terrific heat of the oxwelding flame; you remove the flame, and the broken parts "freeze" together as before the break happened. That's oxwelding.

Every time you throw away a broken metal part at your plant you throw away that much cash. For the new part you buy is not a whit better than the old part after oxwelding. *The new part may cost you 300 dollars; the oxwelded good-as-new old part—300 cents.*

Write to us for bulletins showing the advantages of oxwelding in your industry

OXWELD ACETYLENE COMPANY

NEWARK, N. J. CHICAGO LOS ANGELES

World's Largest Maker of Equipment for Oxwelding and Cutting Metal

MILBURN APPARATUS

Milburn mixing principle produces best work with minimum gas, and no flash backs, burnt tips, or other annoyances.

Exceptionally durable construction of torches insures long, satisfactory service. Regulators dependable and free from valve, diaphragm and gauge troubles.

Ask for Catalogue No. 35.

The Alexander Milburn Company
Baltimore, Maryland

60%

A Hauck "Oneman" Compressed Air Type Preheating Outfit

REDUCTION IN ACETYLENE AND GAS— 75%

SAVING in TIME and LABOR

WHEN WELDS ARE PREHEATED WITH A

HAUCK OIL BURNER

Write for Pamphlet 93W

HAUCK MANUFACTURING COMPANY

107 Eleventh Street Brooklyn, N. Y.

Quality—The Best
Prices—Right
Delivery—From Stock

BIERMAN-EVERETT
WELDING SUPPLIES

have been developed with the growth of the Welding Process, having been on the market since welding was in its infancy, and the constantly increasing demand for these supplies is the best testimonial that can be offered.

PRICES CHEERFULLY QUOTED

Rods Wires Fluxes

BIERMAN-EVERETT FOUNDRY CO.

IRVINGTON, N. J.

K-G SERVICE

1 Apparatus substantially built of the best materials made. Gas and oxygen mixing and consumption guaranteed to be in correct proportions to produce the correct flame and economy.

2 All accessories and supplies of the best quality.

3 The most completely equipped welding shop in New York City and capable of handling the largest castings or any quantity of manufacturers work—men and apparatus supplied for outside work.

4 A large stock of acetylene and Oxygen always on hand to supply our trade at the lowest market prices.

5 Everything needed for oxy-acetylene work we supply.

K-G Welding & Cutting Co.

Incorporated

556 West 34th St., New York City

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

ACETYLENE (Compressed in Cylinders)
Commercial Acetylene Welding Co.
Universal Oxygen Co.

ACETYLENE CYLINDERS

ACETYLENE GENERATORS
Air Reduction Sales Co.
Bermo Supply Co.
Davis-Bournonville Co.
The Harris Calorific Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.

ALUMINUM FILLER RODS
Air Reduction Sales Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Hauck Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Mach. Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

ALUMINUM FLUX
Air Reduction Sales Co.
Bermo Supply Co.
Burdett Oxygen Co.
Chicago Welding Compound Co.
Cortland Welding Compound Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Hauck Mfg. Co.
L. Lawrence & Co.
Morey Flux & Chemical Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

ALUMINUM SOLDER
Air Reduction Sales Co.
Burdett Oxygen Co.

ANNEALING FURNACES
Buffalo Dental Mfg. Co.
Universal Oxygen Co.

APRONS (Asbestos)
Chicago Eye Shield Co.

ASBESTOS GLOVES
Air Reduction Sales Co.
Burdett Oxygen Co.
Chicago Eye Shield Co.

ASBESTOS SHEET PAPER
Air Reduction Sales Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.

BLOW TORCHES (Acetylene)
Air Reduction Sales Co.
American Welding Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Buffalo Dental Mfg. Co.
Federal Brass Works.
Hauck Mfg. Co.
Smith's Inventions, Inc.
The Alexander Milburn Co.
Torchweld Equipment Co.

BOOKS (Relating to Welding)
The Welding Engineer
P. F. Willis.

BRASS AND BRONZE FLUX
Air Reduction Sales Co.
Burdett Oxygen Co.
Cortland Welding Compound Co.
Hauck Mfg. Co.
Bermo Supply Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
United States Welding Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
Universal Oxygen Co.

BRASS SPELTER WIRE
Air Reduction Sales Co.
Burdett Oxygen Co.
Universal Oxygen Co.
Torchweld Equipment Co.

BRAZING OUTFITS
Buffalo Dental Mfg. Co.
Hauck Mfg. Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.

BRONZE FILLER RODS
Air Reduction Sales Co.
Burdett Oxygen Co.
Hauck Mfg. Co.
Bermo Supply Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

CARBIDE (Calcium)
Canada Carbide Sales Co.
Union Carbide Sales Co.

CARBON (Blocks, Paste, Etc.)
National Carbon Co.

CARBON REMOVING TORCHES
Air Reduction Sales Co.
The Bastian-Blessing Co.
Burdett Oxygen Co.
Bermo Supply Co.
Davis-Bournonville Co.
Federal Brass Works.
The Harris Calorific Co.
Henderson-Willis Welding & Cutting Co.
The Imperial Brass Mfg. Co.
Messer Mfg. Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Mach. Co.
Torchweld Equipment Co.
Universal Oxygen Co.

CAST IRON FILLER RODS AND FLUX
Air Reduction Sales Co.
Bermo Supply Co.
Burdett Oxygen Co.
Bierman-Everett Fdy. Co.
Chicago Welding Compound Co.
Cortland Welding Compound Co.
Davis-Bournonville Co.
Hauck Mfg. Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

CRANES (Portable)

ELECTRIC ARC WELDING OUTFITS
The Arcwell Corp.
The Lincoln Electric Co.
General Electric Co.

ELECTROLYTIC CELLS
Burdett Oxygen Co.
Electrolabs.
International Oxygen Co.

ELECTROLYTIC OXYGEN AND HYDROGEN GENERATING EQUIPMENT
Air Reduction Sales Co.
Burdett Oxygen Co.
Electrolabs.
International Oxygen Co.
Universal Oxygen Co.

FILLER RODS (Aluminum)
Air Reduction Sales Co.
Bierman-Everett Fdy. Co.
Burdett Oxygen Co.
Hauck Mfg. Co.
Torchweld Equipment Co.
United States Welding Co.

FILLER RODS (Swedish Iron)
Air Reduction Sales Co.
Bierman-Everett Fdy. Co.
Burdett Oxygen Co.
Bermo Supply Co.
Davis-Bournonville Co.
Hauck Mfg. Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Steel Sales Corp.
Universal Oxygen Co.

FILLER RODS (Tobin Bronze)
Air Reduction Sales Co.
Burdett Oxygen Co.
Bermo Supply Co
Bierman-Everett Fdy. Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Steel Sales Corp.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

FILLER RODS (Vanadium Steel)
Air Reduction Sales Co.
Bermo Supply Co.
Burdett Oxygen Co.
Bierman-Everett Fdy. Co.
Davis-Bournonville Co.
Hauck Mfg. Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Steel Sales Corp.
Torchweld Equipment Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.

FIREPROOF PLASTIC
Bermo Supply Co.

FLUE WELDERS (Electric)

FURNACES (Annealing)
Buffalo Dental Mfg. Co.
Hauck Mfg. Co.
Universal Oxygen Co.

GASOLINE PREHEATING FURNACES
Buffalo Dental Mfg. Co.
Hauck Mfg. Co.
Superior Oxy-Acetylene Machine Co.

GAS BURNERS (Preheating)
Air Reduction Sales Co.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.

GAS FLOW INDICATORS
Hanan Engineering Co.

GENERATORS (Oxygen or Hydrogen)
Burdett Oxygen Co.
Electrolabs.
International Oxygen Co.
Universal Oxygen Co.

GLOVES (Welders Asbestos)
Burdett Oxygen Co.
Davis-Bournonville Co.
Torchweld Equipment Co.

GOGGLES
Chicago Eye Shield Co.

GRINDING MACHINES

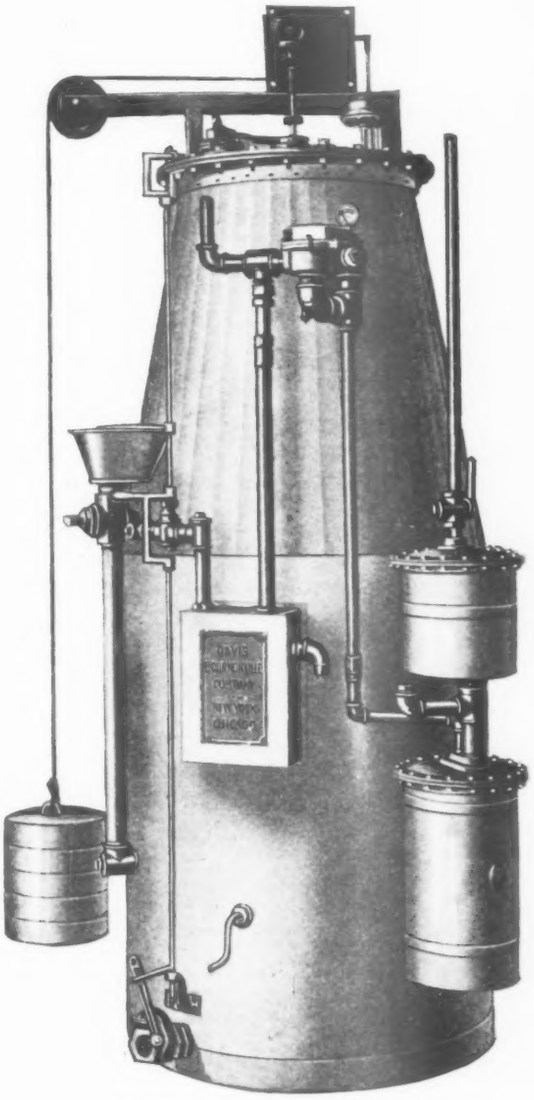
HARDENING FURNACES
Buffalo Dental Mfg. Co.
Hauck Mfg. Co.

HOSE (Oxygen and Acetylene)
Air Reduction Sales Co.
Burdett Oxygen Co.
Bermo Supply Co.
Buffalo Dental Mfg. Co.
Davis-Bournonville Co.
Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

HOISTING MACHINERY

HOSE UNIONS
Air Reduction Sales Co.
Bermo Supply Co.
K-G Welding & Cutting Co.
Hauck Mfg. Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.

HYDROGEN GENERATING APPARATUS
Air Reduction Sales Co.
Burdett Oxygen Co.
Electrolabs.
International Oxygen Co.
Universal Oxygen Co.



No. 300 Davis Acetylene Generator. Height 9 ft. 7 in.; weight 1,000 lbs.

Acetylene Pressure Generation In Your Own Plant

The largest steel mills, foundries, ship yards, locomotive and car shops and sheet-metal working plants, making the most extensive use of the oxy-acetylene process in welding and cutting, for manufacturing and for repair work, generate acetylene in their own plants as it is wanted with Davis Acetylene Pressure Generators—the acme of efficiency, simplicity and economical production. Acetylene at approximately 1 cent per cubic foot, under working pressure, automatic operation, piped to any part of the plant, and no gas holders with storage of free gas.

Made in three types—stationary, portable, and two-pressure generators for combined pipe-line service and compression into portable cylinders. Stationary acetylene pressure generators in five sizes:

No.	Carbide Capacity	Water Capacity	Acetylene per hour
25	25 lbs.	25 gals.	25 cu. ft.
50	50 lbs.	50 gals.	50 cu. ft.
100	100 lbs.	100 gals	100 cu. ft.
200	200 lbs.	200 gals.	200 cu. ft.
300	300 lbs.	300 gals.	300 cu. ft.

Hourly output is in accordance with the rules of the Underwriters' Laboratories of the National Board of Fire Underwriters.

Davis Generators are installed in batteries for greater requirements; many plants have batteries of from two to twelve of the No. 300 Generators. Carbide is estimated to produce from four to five cubic feet of acetylene per pound of carbide, a full charge to operate for the full working period of four to five hours.

Davis Acetylene Pressure Generators were designed specially for Oxy-Acetylene Welding and Cutting installations, and are manufactured with twenty years of experience in acetylene generation. They were the first automatic-feed pressure generators, the first on the inspected list of the National Board of Fire Underwriters, and have been in constantly increasing successful use. The list of successful users is significant—**write for it** and for detailed information and engineering service to determine the practicability of operation in your own plant.

DAVIS-BOURNONVILLE COMPANY

OXY-ACETYLENE WELDING DAVIS APPARATUS DAVIS-BOURNONVILLE CO. N.Y.

Atlanta	Cleveland	Minneapolis	St. Louis
Boston	Detroit	Niagara Falls	San Francisco
Chicago	Jersey City	Philadelphia	Seattle
Cincinnati	Los Angeles	Pittsburgh	Washington, D. C.

General Offices, Jersey City, N. J. Factories at Jersey City, Elkhart, Ind., Niagara Falls, Ont.

HYDROGEN PLANTS
Burdett Oxygen Co.
Electrolabs.
International Oxygen Co.

KEROSENE PREHEATING TORCHES
Air Reduction Sales Co.
Hauck Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.

NEEDLE VALVES
Air Reduction Sales Co.
Burdett Oxygen Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Buffalo Dental Mfg. Co.
Federal Brass Works.
K-G Welding & Cutting Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.

OIL BURNERS (Preheating)
Air Reduction Sales Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Mach. Co.

OXYGEN (Compressed in Cylinders)
Air Reduction Sales Co.
Burdett Oxygen Co.
The Linde Air Products Co.
Swift & Co.
Universal Oxygen Co.

OXYGEN AND HYDROGEN GENERATING EQUIPMENT
Burdett Oxygen Co.
Electrolabs.
International Oxygen Co.
Universal Oxygen Co.

OXYGEN CYLINDERS

PIPE WELDING
Goldschmitt Thermit Co.

PHOTOGRAPHS
Chicago Architectural Photographing Co. (Specialists in photographs relating to the welding industry)

PLASTIC (Fireproof)

PRESSURE GAUGES
Air Reduction Sales Co.
Bastian & Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
Federal Brass Works.
Hauck Mfg. Co.
The Imperial Brass Mfg. Co.
National Gauge & Eq'p't Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
U. S. Gauge Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

REGULATING VALVES (Acetylene)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
Federal Brass Works.
Hauck Mfg. Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

REGULATING VALVES (Hydrogen)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Burdett Oxygen Co.
Bermo Supply Co.
Federal Brass Works.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Superior Oxy-Acetylene Machine Co.
Smith's Inventions, Inc.
Torchweld Equipment Co.
Universal Oxygen Co.

REGULATING VALVES (Oxygen)
The Bastian-Blessing Co.
Air Reduction Sales Co.
Bermo Supply Co.
Burdett Oxygen Co.
Federal Brass Works.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Smith's Inventions, Inc.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

SCHOOLS OF WELDING

SEAM WELDERS (Electric)
General Electric Co.

SEAM WELDERS (Electric Resistance)

SPOT WELDERS (Electric Resistance)

TANK CONNECTIONS (Oxygen and Acetylene Adaptors)
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.

THERMALENE-GAS
The Thermalene Co.

THERMIT WELDING
Goldschmidt-Thermit Co.

TORCHES (Gasoline and Kerosene Preheating)
Air Reduction Sales Co.
Buffalo Dental Mfg. Co.
The Imperial Brass Mfg. Co.
Hauck Mfg. Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Westinghouse Electric & Mfg. Co.

TORCHES (Oxy-Acetylene Cutting)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
Federal Brass Works.
The Harris Calorific Co.
Henderson-Willis Welding & Cutting Co.
The Imperial Brass Mfg. Co.
Messer Mfg. Co.
Welding Supply Co.
K-G Welding & Cutting Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
The Thermalene Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

TORCHES (Oxy-Acetylene Welding)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
Federal Brass Works.
The Harris Calorific Co.
Messer Mfg. Co.
Henderson-Willis Welding & Cutting Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
The Thermalene Co.
United States Welding Co.
Universal Oxygen Co.

TORCHES (Oxy-Hydrogen Cutting)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
Federal Brass Works.
Messer & Co.
The Harris Calorific Co.
Henderson-Willis Welding & Cutting Co.
The Alexander Milburn Co.
The Imperial Brass Mfg. Co.
Torchweld Equipment Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.

TORCHES (Oxy-Hydrogen Welding)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Burdett Oxygen Co.
Messer Mfg. Co.
Buffalo Dental Mfg. Co.
Davis-Bournonville Co.
Federal Brass Works.
The Harris Calorific Co.
Henderson-Willis Welding & Cutting Co.
The Imperial Brass Mfg. Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

TORCHES (Special to Order)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Federal Brass Works.
The Harris Calorific Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.

TRUCKS (Cylinder Carriers)
Air Reduction Sales Co.
Davis-Burnonville Co.
The Dayton Display Fixture & Novelty Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

VALVES (For Oxygen Cylinders)
The Bastian-Blessing Co.
Air Reduction Sales Co.
Burdett Oxygen Co.
Universal Oxygen Co.

WELDING APPARATUS
See also "Torches."

WELDING APPARATUS (Electric)
The Arcwell Corp.
General Electric Co.

WELDERS' GLOVES
Chicago Eye Shield Co.
William C. Adams.

WELDERS' GOGGLES
Air Reduction Sales Co.
Burdett Oxygen Co.
Chicago Eye Shield Co.
Torchweld Equipment Co.

WELDING (Oxygen for)
The Linde Air Products Co.
Air Reduction Sales Co.
Burdett Oxygen Co.
Universal Oxygen Co.
Atlas Foundry Co.

WELDING RODS
Air Reduction Sales Co.
Bierman-Everett Fdy. Co.
Burdett Oxygen Co.
Oxweld Acetylene Co.
Page Steel & Wire Co.
Steel Sales Corp.
Torchweld Equipment Co.

ALPHABETICAL INDEX TO ADVERTISERS

A
Adams, William C. 8
Air Reduction Sales Co. 49-51
Anti-Borax Compound Co. 49
Arcwell Corporation, The 12
Atlas Foundry Co. 9

B
Bastian-Blessing Co., The 26-27
Bermo Supply Co. 50
Bierman-Everett Fdy. Co. 3
Buffalo Dental Mfg. Co. 9
Burdett Oxygen Co. 48

C
Canada Carbide Sales Co. 41
Chicago Eye Shield Co. 43
Chicago Welding Compound Co. 48
Commercial Acetylene Supply Co. ..Back Cover
Cortland Welding Compound Co. 15

D
Davis-Bournonville Co. 5
Dayton Display Fixture & Novelty Co. .....

E
Electrolabs 45

F
F. D. Farnam & Co. 43
Federal Brass Works 14

G
General Electric Co. 10
General Welding & Equipment Co. 37
Geist Mfg. Co. 11

H
Hanau Engineering Co. 8
The Harris Calorific Co. .....
Henderson-Willis Welding & Cutting Co. .. 13
Hauck Mfg. Co. 3

I
Ideal Face Shield Co. 47
Imperial Brass Mfg. Co. 49
International Oxygen Co. 43

K
K-G Welding & Cutting Co. 3

L
L. Lawrence Co. 50
The Lincoln Electric Co. .....
Linde Air Products Co. 20

M
Messer Mfg. Co. 50
Metal & Thermit Corp. 19
Metal & Thermit Corp. 17
The Alexander Milburn Co. 3
Morey Flux & Chemical Co. 50
Modern Engineering Co. 47

N
National Carbon Co. 50
National Gauge Eqpt. Co. 47

O
Oxweld Acetylene Co. 2

P
Page Steel & Wire Co. 33

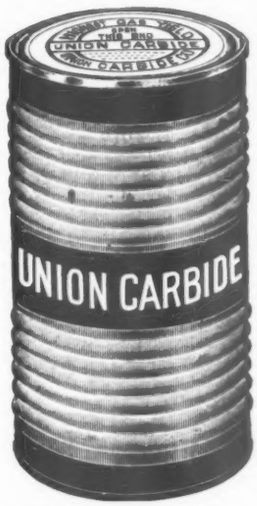
R
Rochester Welding Works 35

S
Smith's Inventions, Inc. 39
Superior Oxy-Acetylene Machine Co. 50
Swift & Co. 13
Steel Sales Corporation 33
Sorenson, C. 16
Southern Welding Mach. Co. 35

T
The Thermalene Co. 50
R. J. Tobin 9
Torchweld Equipment Co. .....Front cover

U
Union Carbide Sales Co. 7
United States Welding Co. 50
Universal Oxygen Co. 9
U. S. Gauge Co. 8

W
Willis, F. F. 45



Packed in Blue and Gray Drums

Union Carbide Sales Company

New York City, 42nd St. Building | **Chicago, Ill., Peoples Gas Building** | **San Francisco, Cal., Kohl Building**

SOLE DISTRIBUTORS OF

UNION CARBIDE

"World's Best Quality—Highest Gas Yield"

For Oxy-Acetylene Welding Plants

Contractors' Flare Lights, Torches and Private and Municipal Lighting Plants

"Union Carbide" is packed in 100-lb. blue and gray drums marked conspicuously, "UNION CARBIDE."

The following sizes are carried in stock in 100-lb. drums:

$3\frac{1}{2}$ x 2 in. —a large size.

$1\frac{1}{4}$ x $\frac{3}{8}$ in. —an intermediate size.

2 x $\frac{1}{2}$ in. —a medium size.

$\frac{1}{4}$ x 1/12 in. —finely crushed size.

Union Carbide in the Generator sizes above listed will be shipped direct to consumers from a **Union Carbide Sales Co.** warehouse at any one of the following points where large stocks are kept on hand:

ALABAMA
Birmingham—1916 Morris Ave.
Mobile—16 S. Commerce St.
Montgomery—114 N. Perry St.

ARIZONA
Phoenix—42 S. Central Ave.

ARKANSAS
Fort Smith—109-123 So. Ninth St.

CALIFORNIA
Fresno—932 H St.
Los Angeles—639 Gibbon St.
Sacramento—1523-31 Front St.
San Diego—326-336 Fifth St.
San Francisco—Kohl Building.

COLORADO
Denver—Nineteenth and Wazee Sts.

CONNECTICUT
Hartford—412 Trumbull St.

DISTRICT OF COLUMBIA
Washington—Maryland Ave. and 9th St., S. W.

FLORIDA
Jacksonville—515 W. Bay St.
Tampa—107 Madison St.

GEORGIA
Atlanta—Cor. Haynes and Rhodes Sts., P. O. Box 1594.
Savannah—Ogeechee Canal, South of Bay St., P. O. Box 78.

ILLINOIS
Chicago—Peoples Gas Bldg., Michigan Blvd.
Decatur—133-147 W. Williams St.
East St. Louis—600 Walnut Ave.
Peoria—100-110 Edmund St.
Monmouth—124 E. Archer Ave.
Marion—315 S. Granite St., Box 747.
Quincy—222 S. Eighth St.
Streator—702 East Elm St.

INDIANA
Evansville—1601 Illinois St.
Indianapolis—110-112 S. Alabama St.
Terre Haute—921 Wabash Ave.

IOWA
Des Moines—117-119 Fifth St.
Dubuque—8th and Washington Sts.
Ottumwa—207-9-11 S. Washington St.
Sioux City—925 Fourth St., P. O. Box 398.

KANSAS
Pittsburg—109 W. Third St.
Salina—154 So. 5th St.
Wichita—721 Beacon Building.

KENTUCKY
Louisville—126 E. Main St.
Middlesboro—1701 Cumberland Ave.

LOUISIANA
New Orleans—819-21 Julia St.

MAINE
Portland—11 Exchange St.

MARYLAND
Baltimore—19 E. Lombard St.
Cumberland—1 N. Liberty St.
Salisbury—Opp. Fulton Station.

MASSACHUSETTS
Boston—(See Cambridge "A.")
Cambridge—241 Albany St.
Springfield—Napier St.

MICHIGAN
Detroit—Grand River and Lorain Ave.
Grand Rapids—500 Shawmut Ave., N. W.
Hancock—First National Bank Bldg.
Iron Mountain—215 E. A St.
Jackson—172 South Water St.
Saginaw—1830 No. Michigan Ave.
Sault Ste. Marie.

MINNESOTA
Minneapolis—334 N. First St.
Virginia—413 Chestnut St.

MISSISSIPPI
Vicksburg—1312 Washington St.

MISSOURI
Kansas City—1316-1318 W. Eighth St.
St. Joseph—920 S. Sixth St., Sta. "A."
St. Louis—(See East St. Louis, Ill.)

NEBRASKA
Omaha—1007-9-11 Jones St., Union Sta. P. O.

NEW JERSEY
Camden—West and Clinton Sts.
Jersey City—554-56 Henderson St.

NEW YORK
Albany—Montgomery and Colonie Sts.
Binghamton—21 Jarvis St.
Geneva—Exchange St. and Railroad Pl.
Jamaica—11 New York Ave.
Kingston—O'Neil St., near Broadway.
New York.
Niagara Falls.
Poughkeepsie—Smith St. and N. Y., N. H. & H. R. R. Tracks.
Roscoe.
Utica—135 Hotel St.
Watertown—438 Court St.
Whitehall—22 Main St.

NORTH CAROLINA
Wilmington—Room 16 Masonic Temple, 13 N. Front St.

NORTH DAKOTA
Fargo—17 Broadway.

OHIO
Cincinnati—63-65 Plum St.
Cleveland—601 The Citizens' Building.
Columbus—330 Dublin Ave.
Dayton—812-828 E. First St.
Lima—338 East High St.
Toledo—414 S. Erie St.
Zanesville—Main and Second Sts.

OKLAHOMA
Oklahoma City—27-29 E. Grand Ave.

OREGON
Portland—Fifteenth and Hoyt Sts.

PENNSYLVANIA
Beaver—359 Beaver St.
Du Bois—Weber Ave. and Franklin St.
Erie—1426 Chestnut St.
E. Greensburg—Clark and George St.
Harrisburg—627 Walnut St.
Johnstown—Messenger St. & B. & O. R. R.
Pittsburgh—1202 Chamber of Commerce Building.
Pottsville—Railroad and Sanderson Sts.
Scranton—Penn Ave. and Vine St.
Shamokin—5th and Walnut Sts.
Williamsport—Canal and Court Sts.

SOUTH CAROLINA
Charleston—153 Church St.

TENNESSEE
Chattanooga—627 Volunteer State Ins. Bldg.
Knoxville—426 West Depot Ave.
Memphis—671 South Main St.
Nashville—105-107-109 Broadway.

TEXAS
Dallas—802-810 Cadiz St.
El Paso—900 E. Overland St.
Houston—Baker and Cedar Sts., Box 745.
San Antonio—Cor. Leal and N. Salado Sts.
Waco—13th and Mary Sts.

UTAH
Salt Lake City—108 West 2nd South St.

VIRGINIA
Lynchburg—1324 Commerce St.
Norfolk—513 Front St.
Richmond—18th and Cary Sts.

WEST VIRGINIA
Bluefield—195 Roanoke St.
Charleston—Broad St. and K. & M. R. R.
Fairmont—"A" Street.
Huntington—820 3rd Avenue.

WASHINGTON
Seattle—1103 First Ave.
Spokane—646 Peyton Building.

WISCONSIN
La Crosse—Front and King Streets.
Madison—513-19 Williamson Street.
Milwaukee—120-134 Jefferson St.

We recommend our customers to **select** from the list, the **city** from which the quickest delivery and lowest freight rate can be obtained, **and address their orders to "Union Carbide Sales Company"** at the distributing point selected **accompanied by remittance.**

Please address request for information or special correspondence to either the New York or Chicago office.

SAFETY FIRST

Patented July, 1916

OXY-ACETYLENE GAUGES

for

WELDING and CUTTING APPARATUS

United States Gauge Co.

67 Wall St., New York

WORKS:
Sellersville, Pa.

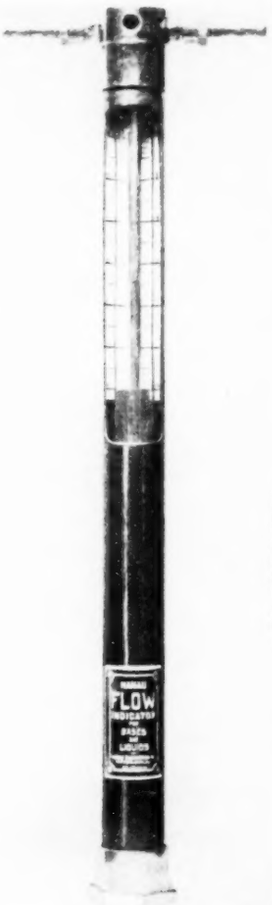
BRANCHES:

Clark St. Bridge
Chicago, Ill.

42 W. Larned St.
Detroit, Mich.

681 Market Street
San Francisco

Board of Trade
Montreal, Can.



Your ***Welding*** or ***Cutting Outfit*** is ***not complete*** unless you use a

"HANAU FLOW INDICATOR"

(Patent applied for)

A **simple means** to indicate the **exact rate of consumption** of Acetylene, other combustible gases or Oxygen.

To control the **efficiency** of the different operators, or of the different makes of torches or tips.

An automatic, reliable and simple way for skilled or unskilled men **to obtain a desired flame,** i. e.
Correct intensity,
Correct strength,
Correct action.

RESULT:
Saving in gas, time and labor,
Better work.

Price $40 f.o.b. Pittsburgh.

Write for further information.

Hanau Engineering Company
410 Bessemer Bldg., Pittsburgh, Pa.

WELDERS' GOGGLE No. 3

White non-rusting metal, folding screens, all metal parts covered to prevent the frame from getting heated and burning the skin. Fastened on by an elastic headband.

No. 3. Mounted with first quality, gray green glass ..... $1.50 each
Mounted with the new American Noviweld glass ..... $2.00 each
Quantity prices upon application

After experimenting for two years we have succeeded in producing a glass especially for Welders, equal, if not superior, to the German make. The Gray green glass used in our goggles is an American product.

The above goggles furnished with light smoked, blue, amber or clear white glasses.

WILLIAM C. ADAMS

Manufacturer, Importer and Wholesale Dealer in
Welding Goggles and Protection Glasses
332 BOYLSTON STREET
BOSTON - - - - MASS., U. S. A.
Write for Catalogue. Samples Submitted.

Universal All-Steel Welding Truck

A time-saver and convenience which no progressive welding shop can afford to be without. Made in two sizes; to carry two 100 ft. drums, and to carry two 200 ft. drums.

Truck is equipped with torch hooks on which the torch can be conveniently placed when not in use, and a ten hole tip rack. The welding rod supply box is made to carry eight pounds of welding rods. The supply case, spaced off into compartments, will carry two one-pound cans of flux, cutting tips, adaptors, goggles and wrenches.

The truck has a hand wheel drum tightening device, strongly constructed, and so made that the drums are held tightly, eliminating any shaking when the truck is in motion.

The entire truck is constructed of heavy angle iron, and has a 10 gauge steel platform. It is so constructed that when fully loaded it will balance easily, facilitating rapid transportation. WRITE FOR PRICES TODAY

UNIVERSAL OXYGEN COMPANY : Sheboygan, Wisconsin

Milwaukee Branch, 554-556 E. Water St.

High Silicon Cast Iron Welding Rods

Atlas Quality

Also rods, wires and fluxes for welding all metals. Quality guaranteed.

Prices Cheerfully Quoted.

ATLAS FOUNDRY CO.
IRVINGTON, N. J.

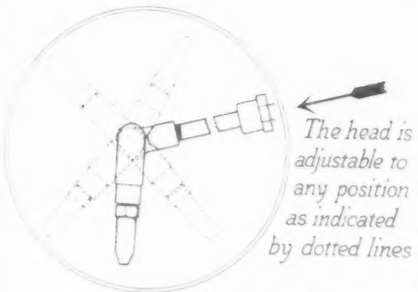
FOR SALE

Davis-Bournonville 25 pound generator in perfect condition. Cannot be told from new. Price $200 F. O. B. cars, Chicago.

Generator, care The Welding Engineer

Tobin's Adjustable Head

Operates from any position. No loss of time or gases. The nozzle may be moved into any desired position without twisting or rotating the handle or hose.



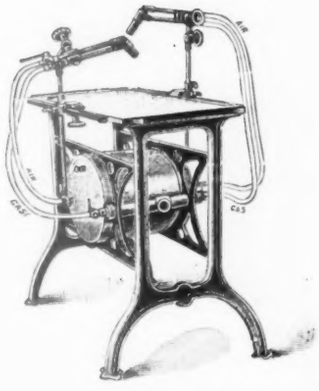
The head is adjustable to any position as indicated by dotted lines

THE TOBIN ADJUSTABLE HEAD

may be attached to any standard welding torch. It is now in successful operation on the Pacific Coast, particularly on Burdett Torches. A constant and uniform flow of gas is assured—no change in your regular torch—simply more flexibility in manipulation. This torch was used on cabinet work on U. S. Destroyers in ship yards, the most inaccessible work being handled with ease. The Tobin Head is equally efficient on heavy work.

Write for prices and particulars.

R. J. Tobin 829 EL DORADO STREET VALLEJO, CAL.

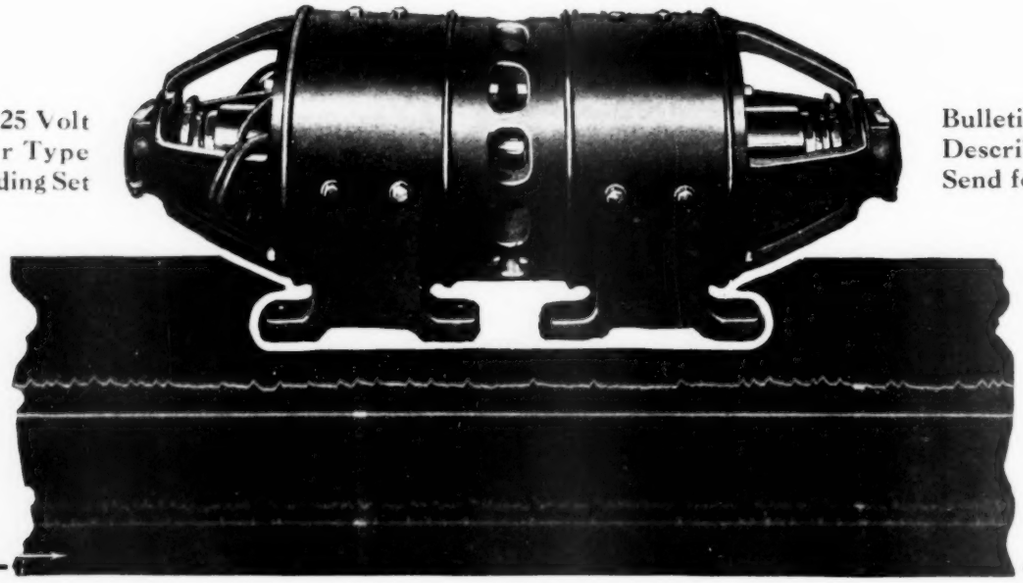


Clean and Quick Method of Brazing

B. D. M. Co.'s No. 101 Gas Brazing Stand for tool rooms or manufacturing purposes, has two powerful gas blowpipes which are adjustable in any direction. The substantial iron frame carries also an air drum and necessary connections as illustrated. Equally effective for a small piece of soldering, or for a heavy job of brazing requiring both blowpipes and a built-up fire-brick backing. Price $40.00. Catalog "B.X." to be had for the asking, tells all about it.

Buffalo Dental Mfg. Co.
Buffalo, N. Y.

3 K.W. 125 Volt
Balancer Type
Arc Welding Set



Bulletin No. 48940
Describes This Set.
Send for it.

Oscillograph curve, showing electrical conditions in welding circuit of constant energy arc welding equipment. Curve "A" shows current in arc, approximate average value 150 amps. Curve "B" shows voltage across arc, approximate average value 15 volts.

Steady Flow of Metal Assured by Efficient and Simple G-E Welders

G-E constant energy arc welding sets are used to assure a steady flow of metal into the weld and high operating efficiency.

A constant flow of metal is assured by the inherent automatic regulation of the energy in the welding circuit throughout the welding range for metal electrodes.

The distribution of welding current between the two units comprising the set and practically dispensing with external resistance in series with arc, assure high efficiency.

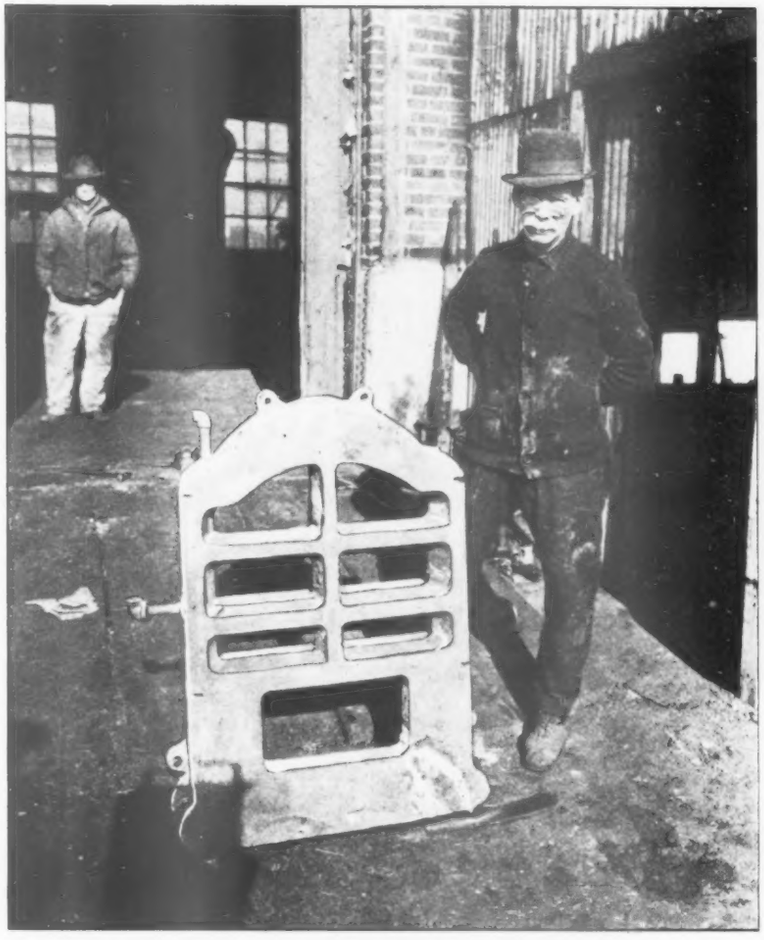
One small panel and the set illustrated are all the equipment needed for a one man outfit where operator has mask and electrode with flexible cable—if 125 volt direct current is available.

Consistently perfect welds are being produced in essential war industries by the use of this equipment.

We are prepared to demonstrate these sets and make good deliveries.

General Electric Company

General Office Schenectady, N.Y.



Heater Section Showing where Piece was Removed and afterward Welded again into Place

Five Cents Saved Every Minute

Are you a welder? Then take a good look at the picture above. You know what kind of a job it is to weld a heater section like this. It would have taken at least $4.50 worth of charcoal to preheat this piece plus all the trouble of building a fire and watching it. To do the job with a torch would have taken dollars and dollars worth of oxygen and acetylene.

The **Wiederwax Preheater** prepared this heater section in 30 minutes. Welding it took 45 minutes. The total consumption of gas during the 75 minutes was 800 cu. feet of gas at $1.00 per 1000 cu. feet, totalling 80c. Fuel cost thus saved was $3.70, or about five cents for every minute.

The section was cracked right through necessitating the welding of both sides. The smaller piece was cut out, the weld made on the inside, and the piece replaced and welded. The section was not turned over during the process. The **Wiederwax Preheater** made a safe, sure, quick job of it and saved $3.70 in the bargain.

HAVE YOU A 'WIEDERWAX' IN YOUR SHOP?

ADDRESS DEPT. X
For Descriptive Booklet and 30-day Free Trial

GEIST MANUFACTURING COMPANY

2001 Atlantic Avenue ***Atlantic City, N. J.***

PRACTICAL WELDERS

WANT TO KNOW

The Cost of Operation

OF

The Mephisto A. C. Welder

If your rate is 3c per k. w. h. your cost on average work would be under 15c per hour.

Compare this with your oxy-acetylene costs.

You can't disregard a saving of this magnitude.

A portable machine with welding current from 40 to 150 amps., with a tap for intermittent cutting. No regulating apparatus or moving parts, with efficiency of over 90%.

SEND FOR BOOKLET 600

THE ARCWELL CORP.

42 BROADWAY N. Y. CITY

C. P. R. BLDG., TORONTO, CANADA

E. M. NOONAN CO.—PHILADELPHIA
R. L. HUNTER—SEATTLE
F. H. DORNER—MILWAUKEE
STRONG, CARLISLE & HAMMOND—CLEVELAND

Announcement

For the past eighteen months, 90% of our factory has been given over to the manufacture of depth mines for our Government. For more than ten years our firm had confined itself exclusively to the manufacture of Oxy-acetylene apparatus and while naturally we were flattered when we were selected to make the most effective instrument used to combat the submarine, at the same time we realized that in undertaking the work, the expansion of our Welding and Cutting Apparatus business would be seriously affected.

We gladly accepted the opportunity of being of some service to our Country, and for the duration of the war, modestly refrained from any reference to the work occupying our every energy, though sometimes by our silence we were misunderstood. Now that patriotism will shortly be supplanted by commercialism, we feel that the above information is due to users of Willis Welders.

Ten years ago, Willis Welders were Good Welders. Since then, they have been refined and improved, and they are still Good Welders. Our policy will be to take care of all our overseas men upon their return, but our enlarged facilities will enable us to use a number of high grade salesmen and representatives. We have no snap jobs to offer, but if you are looking for a better line with compensation corresponding with your ability and energy, we solicit investigation. All correspondence treated confidentially.

Henderson Willis Welding & Cutting Company

11th and North Market Streets ST. LOUIS, MO.

AUTOMOBILE WELDING

With the OXY-ACETYLENE FLAME By M. Keith Dunham

167 Pages Price $1.00 Fully Illustrated

This is the only complete book on the "Why" and "How" of Welding

Explains in a simple manner apparatus to be used, its care, and how to construct necessary shop equipment. Proceeds then to the actual welding of all automobile parts, in a manner understandable by everyone. Aluminum, cast iron, steel, copper, brass, bronze and malleable iron are fully treated, as well as a clear explanation of the proper manner to burn the carbon out of the combustion head. Machine Shops, as well as Industries using the oxy-acetylene flame, will find this book of the utmost value, since the perplexing problems arising when metal is heated to a melting point are fully explained and the proper methods to overcome them shown.

CONTENTS

CHAPTER I.—APPARATUS
KNOWLEDGE.
Oxygen Supply—Care of Oxygen Cylinder—Acetylene Generation—Care of Generator—Regulators—Care of Regulator—Creeting Regulators—Gauges—Care of Gauges—Welding Torch—Torch—Care of Torch and Goggles—Effects of Heat—Hose and Hose Connections.

CHAPTER II.—SHOP EQUIPMENT AND INITIAL PROCEDURE.
Preheating Agencies—Welding Table—Location of Welding Outfit—Adjustment of Welding Outfit—Starting Flame—Principle of Welding—General Welding Knowledge—Welding Rods and Fluxes—Choice of Tip—Expansion and Contraction.

CHAPTER III.—CAST IRON.
Simple Welding—How to Hold the Parts—Hard Cast Iron—Pin Holes and Blow Holes—Lug on Cylinder—Outlet—Cylinder Compression—Scored Cylinders—Cylinder Head—Finishing and Testing—Scored Wheels—Pistons—Crank Cases—Babbitted Bearings—Valve Guides—Preserving Threads—Conclusion of Cast Iron.

CHAPTER IV.—ALUMINUM.
Use of—Welding Knowledge—Puddle System—Flux System—Compartment of Systems—Welding Rod—Preparation of Crank Case—Welding the Arm Without Taking Out the Motor—Break in the Body of Case—Welding Cold —Wrong Method of Setting Up—Lug or Boss Welding—Preheating the Case—Gas Preheating Flame—One Side or Both—Collapse of Weld—Broken Bearings—Direction of Weld—Shrinkage Cracks—Missing Parts—Finishing—Die Moulded Castings—Body—Other Parts.

CHAPTER V.—STEEL.
Welding Knowledge—What Flame Does to Steel—The Welding Rod—Simple Welding—Position of Flame—Reinforcing the Weld—Frame Welding—Lengthening the Chassis—Tube—Worn Parts—Gear Housings—Worn Parts—Light Metal—Case Hardening—Tank—Welding—Gasoline Tank—Welding—Adjacent to Rivets—Shaft Welding—Construction of Parts.

CHAPTER VI.—MALLEABLE IRON, COPPER, BRASS, BRONZE.
How to Detect Malleable Iron—Brazing Malleable Iron—Rear Housing—Reinforcing the Tube to Housing—Building Up Worn Parts—Copper—Brass and Bronze—Silver Soldering.

CHAPTER VII.—CARBON BURNING AND OTHER USES OF OXY-GEN AND ACETYLENE.
Principle of Carbon Burning—Method of Operation—Lead Burning—Soldering—Case Hardening—Heating Uses.

CHAPTER VIII.—HOW TO FIGURE COST OF WELDING.
Oxygen Consumption—Dissolved Acetylene Consumption—Torch Consumption Test—Acetylene Generator Consumption—Cost Card—Conclusion.

Sent to any address postpaid on receipt of $1.00 THE WELDING ENGINEER 608 So. Dearborn St. CHICAGO, ILLINOIS

How Can I Tell An Oxydizing Flame?

It would surprise you to know how many simple questions we are asked every month. Most of them are answered by Dunham's "Automobile Welding." In fact it answers many a question put up to me every month. It's a book every welder should have. The price of the book is $1.00 postpaid. Send me $5.00 today and I'll send you The Welding Engineer f or 3 years ($6.00) and the book ($1.00).

L. B. MACKENZIE

608 S. Dearborn St. **CHICAGO**

We Can Save You Money

ON

GAS AND OXYGEN

USE

WELD-A-CAST Trade Mark FLUXES

"Weld-a-cast" is a scientific combination of chemicals, that causes the metal to melt rapidly, shortening the operation, thus economizing in time, gas and oxygen.

"Weld-a-cast" adheres readily to the hot welding rod which picks up just enough and none is wasted; it does not blow away but melts at once; it eliminates blow holes and leaves the metal soft.

Write For Free Samples

CORTLAND WELDING COMPOUND CO.
CORTLAND, N. Y.

Welding Pincers

Use up the short pieces of Welding Metal

This pincer enables the welder to use up his strips of metal almost to the end, all the time keeping his hand a good distance from the heat.

The handle is always cool, no matter how short is the piece of welding metal.

The time saved in welding the strips together quickly pays for the pincers.

Pressing the spring handle releases the jaws to pick up the metal. Length of pincers, 19 inches. Holds rods of 3-16-inch to ¼-inch diameter.

Price $1.00

One sent to the address of any welding shop for 30 days' trial, on receipt of $1.00. If not satisfied money will be refunded on return of pincers.

Jobbers and Agents, write

C. SORENSEN

18 E. 16th St. CHICAGO

Aluminum and Cast Iron Flux

AN Aluminum break when melted does not flow together as other metals do, but the edges creep away from each other. There is a film on the surface, dull grey in color. This film is **ALUMINUM OXIDE.** It must be destroyed before your weld can be a success. By using **RED DIAMOND** Aluminum Welding Flux the aluminum oxide is instantly destroyed and the metal assumes a bright silvery appearance. By adding **RED DIAMOND** Flux with the hot welding rod, in the usual way, not only does the aluminum oxide disappear, but dirt and grease as well.

A trial can of **RED DIAMOND** Aluminum Welding Flux will convince you that this is the flux you have been waiting for. Put up in 2 pound cans, $3.00 per can.

The best insurance a welder can have that his welds will be sound and free from craters or blow holes is to use a good flux, made scientifically by chemists who understand the needs of the welder.

The object of a cast iron flux, or in fact any flux, is to eliminate the **OXIDE** and other impurities which form on the surface of the weld, caused by the heat and combination with oxygen of the air. The reactions are the same as in a blast furnace or cupola and flux is used to **CARRY OFF THE SLAG.**

BLACK DIAMOND Cast Iron Flux, when dropped on the molten surface of the weld, instantly clears the metal of iron oxide and other foreign substances, leaving a clear, mirror-like surface, which enables the metal to run together. This condition makes a sound weld.

A very small amount of **BLACK DIAMOND** Cast Iron Flux is required to assure a good weld. The price is a secondary consideration—it's the quality that counts. Put up in 2 pound cans, $1.00 per can.

Chicago Welding Compound Co.

Transportation Bldg. Chicago, Ill.

Our Service Department is at your service. Consult us about your flux troubles.

Swift Oxygen

For Welding and Cutting

Unsurpassed for Quality

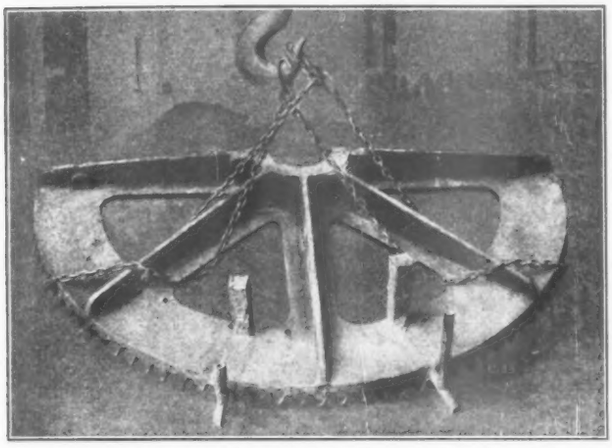
Pure Oxygen Electrolytically Made under the direct supervision of our Chemical Laboratory. It is carefully controlled by chemical analysis, thus insuring the highest obtainable purity.

We carry a large stock on hand—so can fill orders immediately

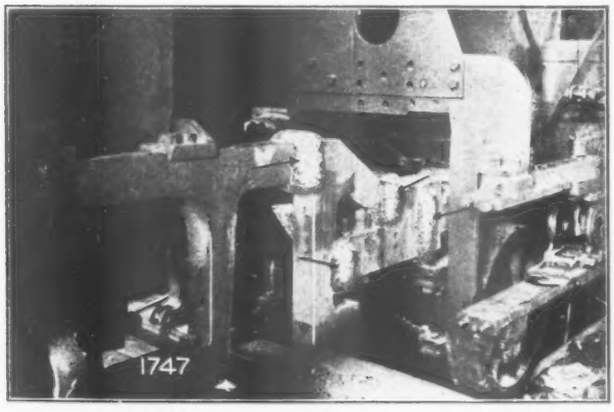
Swift & Company

Oxygen Department Union Stock Yards, Chicago, Ill.

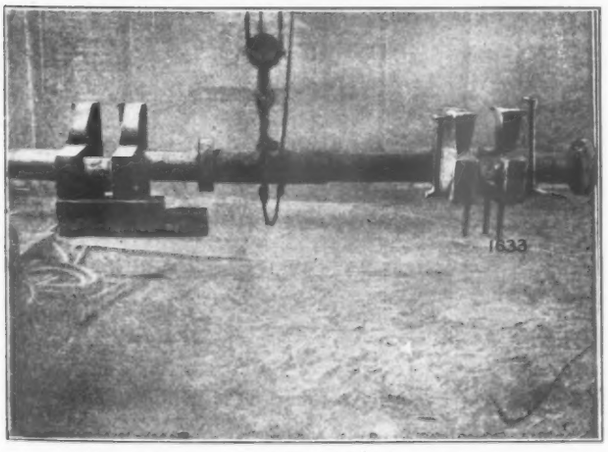
New neck cast on to large roll made with the aid of Thermit and having the pods cast in at the same time.



Large bevel gear on which two new teeth and crack have been repaired.



Four Thermit welds on locomotive frame on the Missouri Pacific Railroad, made without removing the frame from place.



New crank pin welded in by the Thermit Process.

THERMIT

The Only Reliable Process for Welding Heavy Sections

THIS Explains Why Railroads and Steel Mills Used Over One Million Pounds of Thermit in 1917. Also Why 95% of the Railroads in the United States and Canada Having Over 10 Locomotives, Use Thermit for Welding Frames and All Heavy Sections.

There are few machine parts which are subjected to greater strains or more severe shocks than a locomotive frame or a blooming mill pinion. Yet Thermit welds on such parts are being made every day and STAND UP IN SERVICE FOR YEARS. The reason for this is that, unlike ANY OTHER WELDING PROCESS, the steel to make a Thermit weld is produced IN BULK at a temperature of 5000° F. Furthermore, results are not dependent on the individual skill of the operator.

We have ample proof for all our claims and our long list of satisfied customers who come back week after week, month after month, and year after year for MORE THERMIT is a never ending testimonial to the efficiency of the Thermit Process.

Remember that Thermit should not be confused with either oxy-acetylene or electric welding. It stands in a class by itself. It welds sections which cannot be successfully welded by any other method.

Let us tell you more about it. Write for pamphlet No. 1779.

* * * *

Metal and Thermit Corporation

(Successors to Goldschmidt Detinning and Goldschmidt Thermit Co.)

The Equitable Building
120 Broadway, New York

7300 So. Chicago Ave., Chicago
329-333 Folsom St., San Francisco
1427 Western Ave., Pittsburgh
15 Emily St., W., Toronto, Ont.

BURDETT OXYGEN COMPANY

AND ASSOCIATED COMPANIES

ELECTROLYTIC OXYGEN and HYDROGEN - 99 1/2 % Pure

Service from the following BURDETT PLANTS

Seattle, Wash.
Los Angeles, Cal.
Oakland, California
Salt Lake City, Utah
Denver, Colorado
Oklahoma City, Oklahoma
Fort Worth, Texas
St. Louis, Mo.
Detroit, Michigan
Logansport, Ind.
Chattanooga, Tenn.
Cincinnati, Ohio
Pittsburgh, Pa.
Chester, Pa.
Norristown, Pa.
Cleveland, Ohio
Chicago, Illinois

The Largest Producers of the Purest Oxygen in the World

Apparatus for Particular Welders

Approved by the National Board of Fire Underwriters

FEDERAL HIGH PRESSURE gas specialties for Oxygen, Hydrogen and Acetylene Gases are made by high grade workmen, in a high grade plant, of the best materials, for welders who know the value of and appreciate dependable regulators.

FEDERAL regulators are absolutely the b e s t that human ability can produce, they are absolutely safe and guaranteed to give entire satisfaction.

Manufacturers of welding apparatus and users of regulators s h o u l d have our descriptive bulletin.

Good Territory Now Open

Many choice territories are now open to the wide-awake jobber. There is no more profitable line for the live, progressive jobber than the "Federal." Whether you carry Welding and Cutting apparatus or not, write us for our proposition.

Our advertising in trade journals and other means of publicity will help to create sales for you. We will supply you with sales literature with your imprint thereon and our engineers will act as an advisory staff to you.

Write us on your letter head today. Let us tell you of our liberal co-operative proposition.

Federal Brass Works

31st St. and Kedzie Ave. Chicago

Linde Oxygen now on a Peace Basis

THE War Industries Board has withdrawn all restrictions on Oxygen manufacturers and users, effective December 1st. All Direct Priorities, with the exception of a few departments of the Government, and all Automatic Priorities, have been revoked.

We desire, therefore, to do everything in our power to help rapidly build up all Peace work for which Oxygen is required, and have instructed our Distributing Stations to accept and enter orders for shipment on that basis.

As we anticipate a continued heavy demand for our product for some further time we are not curtailing in any way our War construction program, which calls for the completion during the next few months of several new additional manufacturing plants, and additional cylinder equipment represented by thousands of new cylinders now in process of delivery.

In view of these facts we feel safe in assuring all users of Linde Oxygen that their orders will be given the same consideration and attention as before War-time restrictions were imposed.

The whole force of the Linde organization has been directed to the winning of the War. Some day the story of its efforts will be told. Now that it is free to resume activity in the field of general industry, the entire force and complete organization are concentrated on the building up of Peace-time industries.

We ask your co-operation in the matter of returning empty cylinders immediately. Such co-operation will be an important factor in the maintenance of efficient service during the period in which industry is being readjusted to a Peace basis.

Kindly send orders and correspondence regarding their execution direct to the nearest Linde Distributing Station. Inquiries as to prices, terms, etc., should be addressed to our Sales Department, New York, (except for Pacific Coast.)

The Linde Air Products Company

30 East 42d Street
New York City

Kohl Building
San Francisco

306

WELDING OF BOILERS*

By P. F. Willis†

PROBABLY in no field of welding has advancement been faster or the application greater than in the repair of boilers. Cracks, patches and entire sheets are now welded with complete success. Naturally, there are various ways of doing this welding, and it follows that practical men will frequently conscientiously differ as to which method is the best. It is the desire of the author to give to you at least one way of doing the work well. If you can improve over it, so much the better.

The first job we will discuss is the welding of a half side sheet in a locomotive fire box. With the exception of the side which is to be welded the new sheet is prepared exactly as though it were to be riveted in. When possible, all stay bolts should be put in, with the exception of a row on each side of the weld. The mud ring and the door and flue sheets can be riveted in, leaving two or three rivets on each side of the weld so that the flange can be raised up to allow the sheet to be welded underneath.

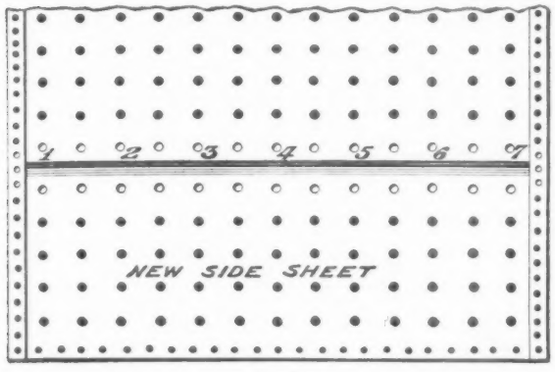


Fig. 36.

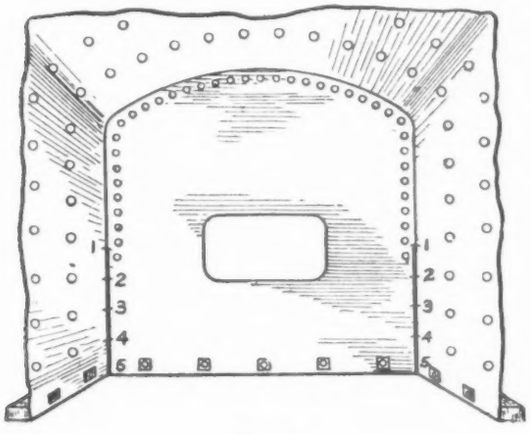


Fig. 37.

If the front and flue sheets are old ones this can be omitted and the flange welded to the side sheet for six or more inches each way. The rivets should be put in after welding. While it is usually more convenient to put in at one time all of the stay bolts and rivets, with the exceptions noted above, it is not necessary, and it can be dispensed with, excepting one row of stay bolts which hold the edges together. No bad effects will follow, the sheet will not draw up a bit and the rivet holes in the mud ring and the stay bolt holes will line up perfectly. Of course, the edges of the new and the old sheet where the weld is to be made are beveled so that they form an angle of 90 degrees. A space or opening about ¼ inch wide is allowed between the two sheets. The new sheet is cut to allow for this, if not a ripping tool is used to provide it. When the sheet is properly fitted the welding is begun. It will now be necessary to refer to Fig. 36, which represents a side sheet ready for welding. The edge next to and under the flange, No. 1, is first welded. We then move ahead about ten inches to No. 2 and weld back to No. 1, then go to No. 3 and weld back to No. 2 and so on across the sheet. It is sometimes necessary to have a pinch bar to pull the edges in line; otherwise, there will be no trouble with the welding. Dozens of sheets have been welded in this way without any trouble, except in the case of a green man who was not able to make a weld. One advantage is, the welder can stop at any time without any trouble.

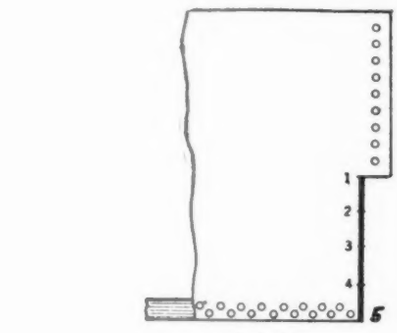


Fig. 38.

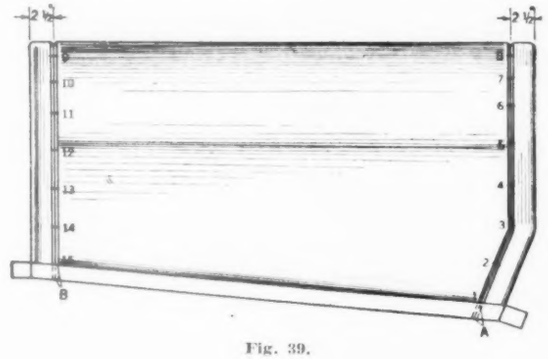


Fig. 39.

There are two other methods used in welding in side sheets, which the writer does not like so well, but which are used by others with from fair to good results. The first consists in dropping one end of the sheet about 2 per cent of the running length. This was perhaps the first method used in this country and some still cling to it. If the sheet is dropped the correct distance, it will pull up into place as the welding progresses. The trouble, however, is

*Reprinted by permission from the third edition of "Oxy-Acetylene Welding and Cutting," by P. F. Willis. This book is advertised elsewhere in this issue. This chapter includes only pages 141 to 177, inclusive.

†President, Henderson Willis Welding & Cutting Co., St. Louis, Mo.

due to the fact that there can be no fixed rule for determining how much the sheet should be dropped for each individual welder. The reason is that this distance which the sheet is dropped is determined to a very considerable extent by the speed of the welder, and no two men weld at the same speed.

The other method consists in putting in the new sheet as though it were to be riveted. The stay bolts are put in except the two or three rows at the top near the line of the weld. Bolts are put through the outer sheet and forced

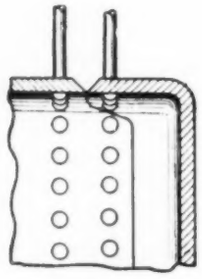


Fig. 40.

against the new sheet. This shoves the new sheet away from the line of the weld. Another bolt is nearer the edge to be welded and it extends to the outer sheet. An assistant on the outside tightens this bolt and pulls the new sheet back into position. By doing this a corrugation or hump is produced in the new sheet just below the line of the weld. The welding can progress from either end, and as it does the bolts should be released, with the result that the contraction pulls the corrugation out, leaving the sheet straight and in good shape.

Fire Box Welded to a Height of Three Feet.

As there is considerable leakage around the rivets which come in contact with the fire, it has been found desirable at times to weld the fire box for a height of about three feet.

In Fig. 37 we show such a fire box with the door sheet fitted to be welded to the side sheets for a distance of about

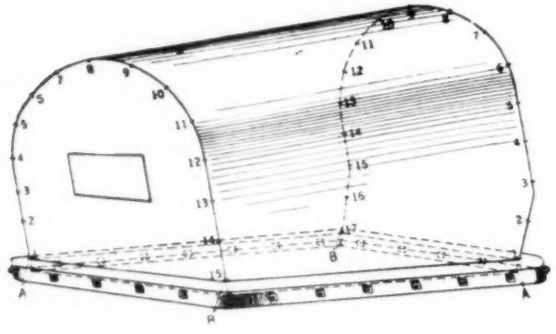


Fig. 41.

three feet above the mud ring. In preparing the flue and door sheets, no rivet holes should be punched where the welding is to be done (Fig. 38). The beveling is to be done as for any other welding operation, with about a $\frac{5}{16}$-inch opening at the bottom of the "V." The fire box should be assembled as usual, puting in the mud ring bolts as usual and riveting the flue and door sheets together. Two or three rivets adjacent to weld No. 1, Fig. 37, should be left out. A No. 6 or No. 7 welding tip or any good medium pressure torch should be used in conjunction with either $\frac{5}{32}$-inch or $\frac{1}{4}$-inch welding wire.

The first procedure is to make a "tack" or weld about 1 or 2 inches long at No. 1, then lift the torch and start welding at No. 2 in the direction of No. 1. When this is finished start at No. 3 and weld to No. 2 and continue in this manner until the seam is welded to top of mud ring at No. 4. The weld should then be completed from the inside of the fire box by welding from No. 5 to No. 4.

When possible, the welding should be done from the water side and finished from the fire box side, using another operator as indicated under instructions for an all welded fire box.

In preparing for an all welding fire box the flue and door should be flanged at least $2\frac{1}{2}$ inches deep, as shown in

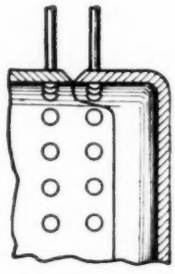


Fig. 42.

Fig. 39. It is desirable to flange the flue sheet at the crown sheets should be flanged at least $2\frac{1}{2}$ inches deep, as shown in 40. The fire box should be fitted to the mud ring in the usual manner, putting bolts on each side of the weld near the edge. Bevel each edge to an angle of 45 degrees so as to form a "V" of 90 degrees with a $\frac{5}{16}$-inch opening at the bottom. Select a No. 6 or No. 7 welding tip or any standard medium pressure torch.

The weld should be made from the water side, except at the mud ring "A" and "B" Fig 41. At these points it should be beveled and welded from the inside of the fire box. Norway welding wire of either $\frac{5}{32}$ or $\frac{1}{4}$-inch diameter should be

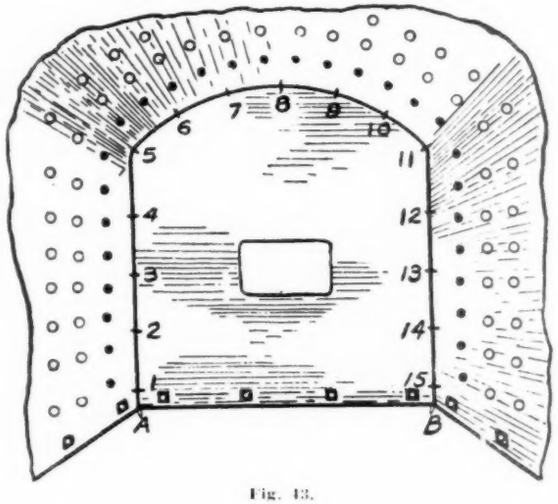


Fig. 43.

used. A special Vanadium steel is preferred by some. The weld should be built up so that it is somewhat thicker than the sheet.

We now come to the welding proper. The first operation consists in welding one or two inches at No. 1, just above the mud ring. (See Fig. 41.) The sheets at the weld are laid off into sections of about 8 or 10 inches in length, these sections being shown by the numerals No. 1 to No. 15 and No. 1 to No. 17, respectively. After the first tack or weld has been made, the torch is lifted and the weld started at No. 2, working towards No. 1. When this 8 or 10 inches is completed, we start at No. 3 and weld back to No. 2, continuing in this manner until the seam is welded to the mud ring at No. 15 or No. 17. Finish by making the welds

at the mud ring "A" to "B." Wherever possible, it is recommended that a second welder be used, working on the inside of the flue sheet at the same point and at the same speed

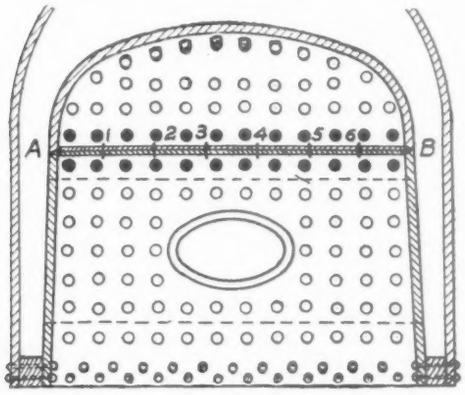


Fig. 44.

as the header welder. This inside man will reinforce and smooth over the weld from his side.

All Welded Door and Flue Sheets.

For this work the preparation consists in fitting the sheets to the mud ring and bolting securely. The edges

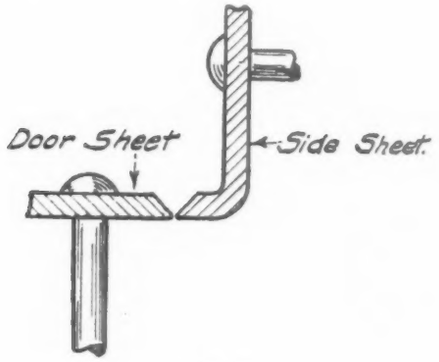


Fig. 45.

should be beveled the same as for any other weld with an opening ⅜ inch wide at the bottom. The flange should be prepared as shown in Fig. 42. Select a No. 6 or No. 7 welding tip and use ⅜ or ¼-inch welding wire. Lay off

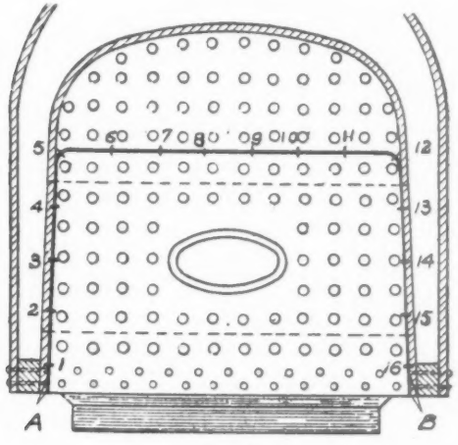


Fig. 46.

the sheet into sections of approximately equal distances of about 10 inches each, as shown in Fig. 42. Start the welding from the fire box side by making a "tack" at No. 1 about 1 or 2 inches long. When this is done, lift the torch and start at No. 4 and weld up to No. 5. Then start at No. 3 and weld to No. 4 and continue in this manner until the last section No. 1 to No. 2 is welded. The last weld for this side is at "A." We now start on the crown sheet, beginning at No. 6

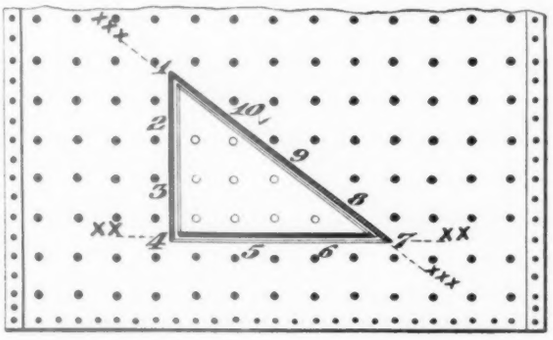


Fig. 47.

and welding to No. 5. This welding should be done from the water side unless the radial stay bolts are in the door sheet, in which event work will be done from the inside of fire box. We next start welding at No. 7 and work back to No. 6, continuing in this manner until both crown and side sheet are welded, finishing No. 15 to No. 14. The last weld is made at the mud ring "B."

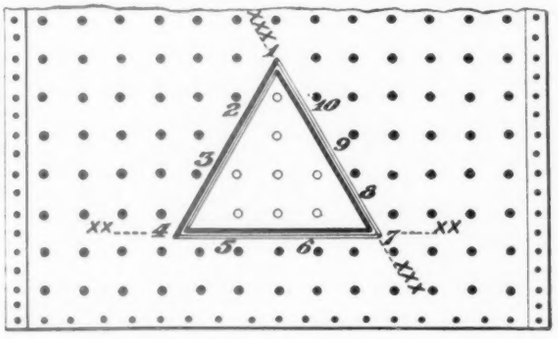


Fig. 48.

Welding Half Door Sheets.

There are some who attempt to weld in a door sheet with the flange riveted on the side sheet. We do not recommend

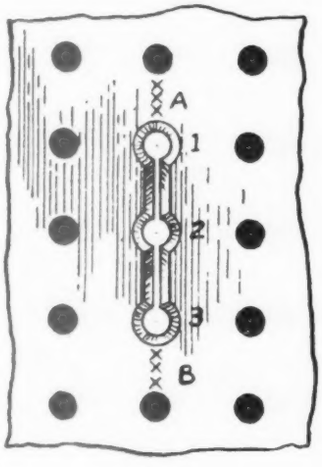


Fig. 49.

this as good practice, believing it is better to either put in an entire new half door sheet and rivet it to the side sheet, or to use an all welded door sheet as will be described be-

low. Fig. 44 shows a half door sheet in position for welding. In preparing the work, cut the end of side sheet to the inner edge of the rivet holes so that in fitting the door sheet will meet the edge of side sheet (Fig. 45). Bevel edges

Fig. 50.

to a "V" of 90 degrees with an opening of ⅛ inch at bottom. Put in all stay bolts except for the row on both sides of the weld. Use a No. 6 or No. 7 welding tip and either ⅛ inch or ¼-inch welding wire. Lay off the sheet into sections No. 1 to No. 16 as shown. Commence at No. 5 and weld the upper and lower flanges of door sheet to side sheet. Then start at No. 4 and weld back to No. 5 and continue in this manner until the last section No. 1 to No. 2 is completed when we make the mud ring weld "A" to No. 1.

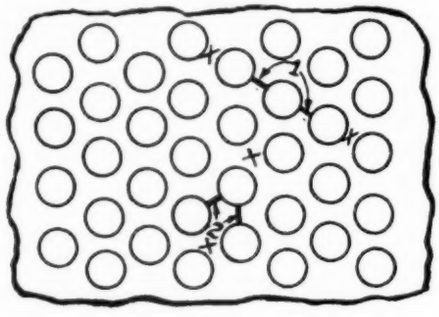


Fig. 51.

We now jump to No. 6 and weld to No. 5, then No. 7 to No. 6 and so on until weld No. 12 to No. 11 is completed, when we weld the upper and lower flanges to the side sheet at No. 12. Then jump to No. 13 and weld back to No. 12 and continue in this manner until section No. 16 to No. 15 is completed, when the final weld at the mud ring "B" to No. 16 is made.

Welding Less Than Full Door Sheet. Having Sides Riveted to Side Sheets.

In preparing, always cut the door sheet so that the weld will not come closer to the door hole than between the first

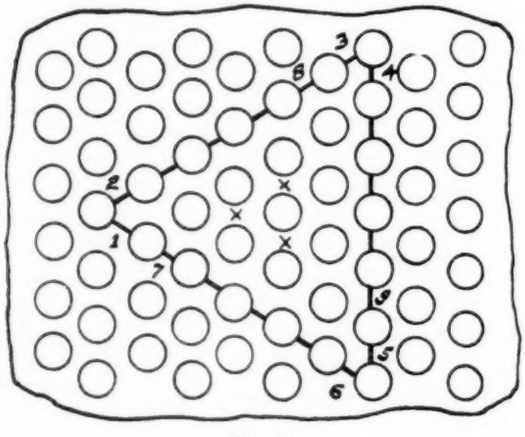


Fig. 52.

and second row of stay bolts. Bevel the edges to an angle of 90 degrees with an opening of ⅛ inch at the bottom of the "V." Screw in all stay bolts except a row on each side of the weld. Rivet door sheet to side sheets and mud ring. Use ⅛ or ¼-inch welding rod and either No. 6 or No. 7 welding tip. Lay off the sheet at the weld into sections of about 10 inches as indicated in Fig. 46. Weld flange at "A" then jump to No. 1 and weld back to "A," then to No. 2

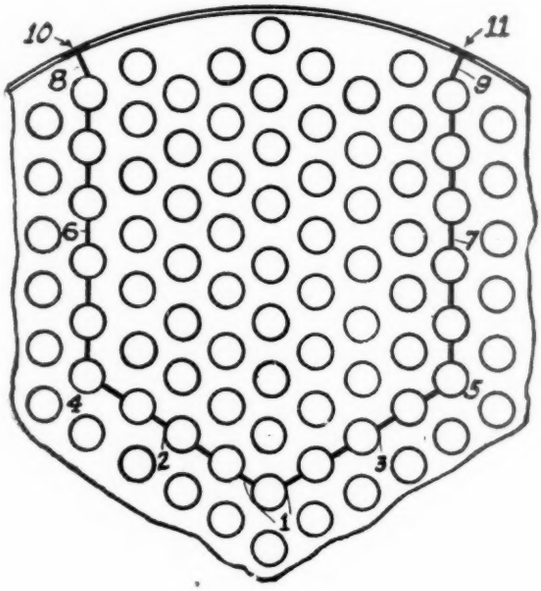


Fig. 53.

and back to No. 1, then No. 3 to No. 2, No. 4 to No. 3 and so on until "B" to No. 6 has been welded, when final weld is made at flange "B."

Welding of a Simple Crack.

The crack is prepared by being beveled to the usual 90-degree angle. A ⅛ to ¼-inch opening is made at the bottom, depending upon the length of the crack. Before welding, heat in the line of the weld for several inches at the ends of the crack. This is done to expand the solid sheet and open the crack. If the crack is a short one of only a few inches, start at one end and finish up at the other and then heat a few inches beyond. If the crack is a long one, say 18 inches or more, instead of starting at the end, begin about 8 inches from the end, and weld back in exactly the same manner as indicated for welding in a side sheet.

Welding of a Patch.

In the welding of patches, it is preferable to use a triangular patch, with the corners slightly rounding, say about 1 inch radius. With this shape of patch there can be no

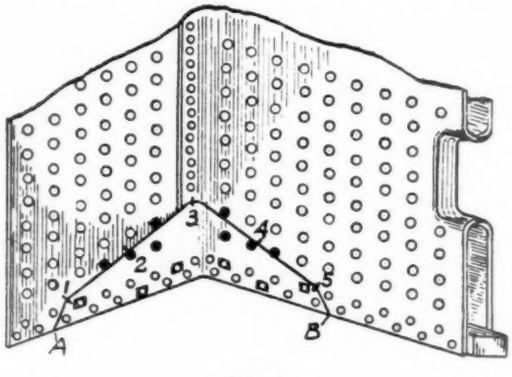


Fig. 54.

parallel welds as is necessary with any other shape, and this is to be desired; also there are only three sides or legs to weld. Each leg of the patch should be straight. The bad place is cut out with the cutting torch and the patch fitted

on, first being prepared by beveling, etc., the same as was done in the case of side sheet and the crack. By referring to Figs. 47 and 48, the manner in which the weld is made will be easier understood.

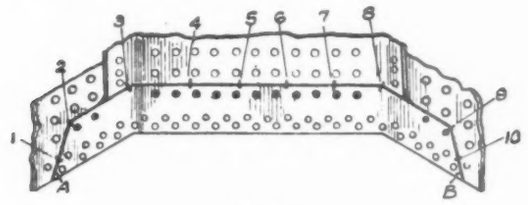


Fig. 55.

In Fig. 47, we show a patch in the form of a right angle triangle and in Fig. 48 the patch is an equilateral triangle. The welding differs little in either. The welding is started at No. 2 and the weld is made towards No. 1, then we go to No. 3 and weld to No. 2 and from No. 4 to No. 3.

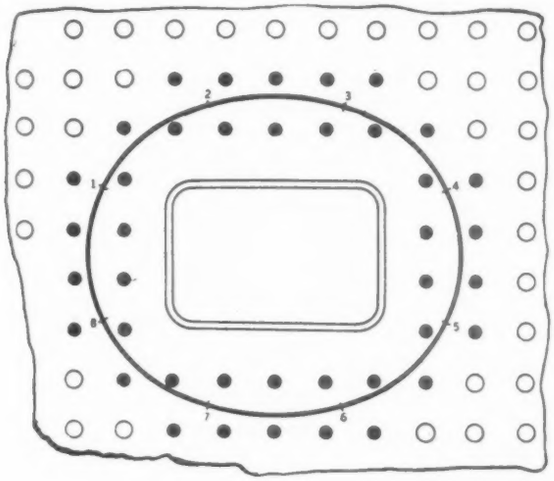


Fig. 56.

It is then preferable to allow the weld to cool down, and then before starting welding heat in the line of the weld No. 4 to No. 7 for about 6 inches at each end, as shown by XX.

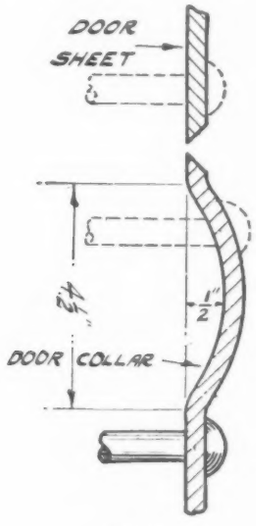


Fig. 57.

Then start welding at No. 5 and weld to No. 4, jump No. 6 and weld to No. 5 and finish this leg with a weld from No. 7 to No. 6. Then let this weld cool and before starting on the final leg heat in the line of the weld No. 7 to No. 1 for about 6 inches as shown by XXX. In making this final weld it is better, if possible, to start at No. 10 and weld to No. 1, then at No. 9 and weld to No. 10 and so on until completed. By doing this the weld is made upwards, which is faster and easier. Of course, conditions are sometimes such

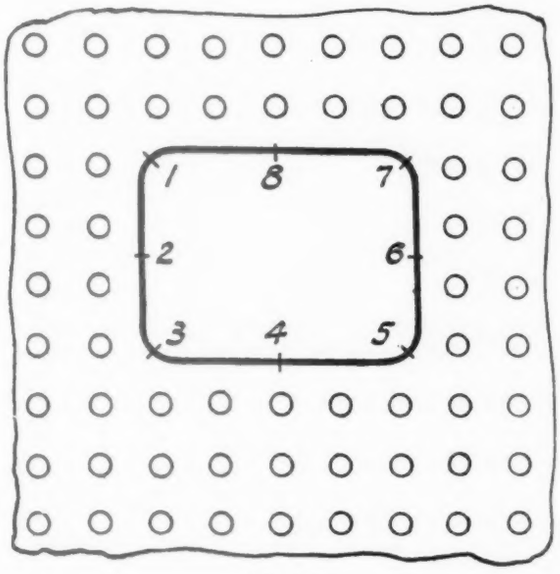


Fig. 58.

that this is not desirable. It is simply a matter of convenience.

There are some who use a dished patch and others one with the edges corrugated. Undoubtedly patches made in this manner are at times of assistance to the welder, but

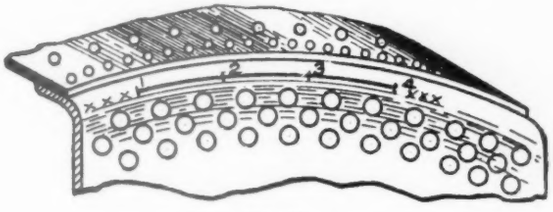


Fig. 59.

the writer is strongly of the opinion that this is not necessary if the welding is done properly.

An examination of a number of welds that proved defective, showed conclusively in nearly every instance that either the welding or the judgment was poor, or both. Any boiler sheet should stand the shrinkage of one welded seam and if that weld is allowed to cool before the next weld is made there will only be the shrinkage of one weld to consider when the last weld is made. There should be very little strain in a weld when cold. Whenever a weld cracks

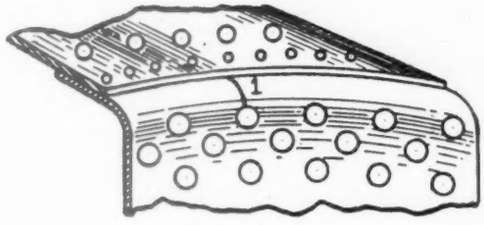


Fig. 60.

immediately after welding while it is still hot, an indication that the weld is poorly made, it will be found that the crack opens widely, sometimes as much as ⅛ of an inch.

If the weld is properly made and it should crack, which will only happen after it becomes cold, it will be found to

REGO WELDING AND CU

OLD vs. NEW

REGO torches are based on a brand new principle. The amazing success of REGO apparatus has proven that principle correct. REGO TORCHES DO EXACTLY WHAT WE CLAIM THEY DO—that is why re-orders are so heavy.

Old and wasteful methods must give way to new and economical. The REGO principle means SOUNDER WELDS, LOWER OPERATING COSTS, because through the new principle of balanced gas mixture it absolutely ELIMINATES THE FLASH-BACK and LESSENS OXYGEN BILLS.

The entire REGO line makes a quick appeal to the intelligent workman anxious to produce BETTER WORK AT LESS EXPENSE; to the manufacturer or repair man because of LOWER OPERATING COST; to the distributor or jobber because he gets repeat orders without sales expense.

As an instance of ONE economical feature of REGO torches, consider this: REGO MODEL "L-10" TIP CONSUMES 100 FEET OF ACETYLENE PER HOUR AND 100 FEET OF OXYGEN PER HOUR. Some torches on the market consume 100 feet of acetylene per hour and 175 feet of oxygen—75 feet of oxygen per hour blown away! Have you one of these gas wasters? Our gas consumption chart (it's free) explains a simple way to test the gas consumption of any torch.

This saving of oxygen is only ONE feature of REGO torches. There are many others. They explain why so many welders, having tried REGO apparatus, throw away their other equipment.

REGO apparatus is sold with the distinct understanding that you may test it yourself and judge for yourself whether or not it does what we claim. If it does, you will keep it; if it does not, you may send it back and we will refund the entire amount paid, irrespective of wear, tear, or damage. Will other manufacturers do the same?

There's REGO apparatus for every purpose. Here are some of the REGO torches:

Model "B" with 3 tips, for lead burning and light sheet metal manufacturing	$ 6.00
Model "W" with 5 tips, for sheet metal manufacturing up to 3/16 inch	15.00
Model "S," with 5 tips, for sheet metal manufacturing up to 5/16 and medium repair work	20.00
Model "L," with 10 tips, for general work	40.00
Model "LL," with 5 tips, for extremely heavy work	55.00
Model "C," for cutting up to 10 inches, made for use with acetylene, hydrogen or carbo-hydrogen in four different head angles, with four one-piece, nickel copper tips	45.00
Model "LC," for cutting up to 24 inches, made for use with acetylene, hydrogen or carbo-hydrogen and with five one-piece, nickel copper tips	80.00

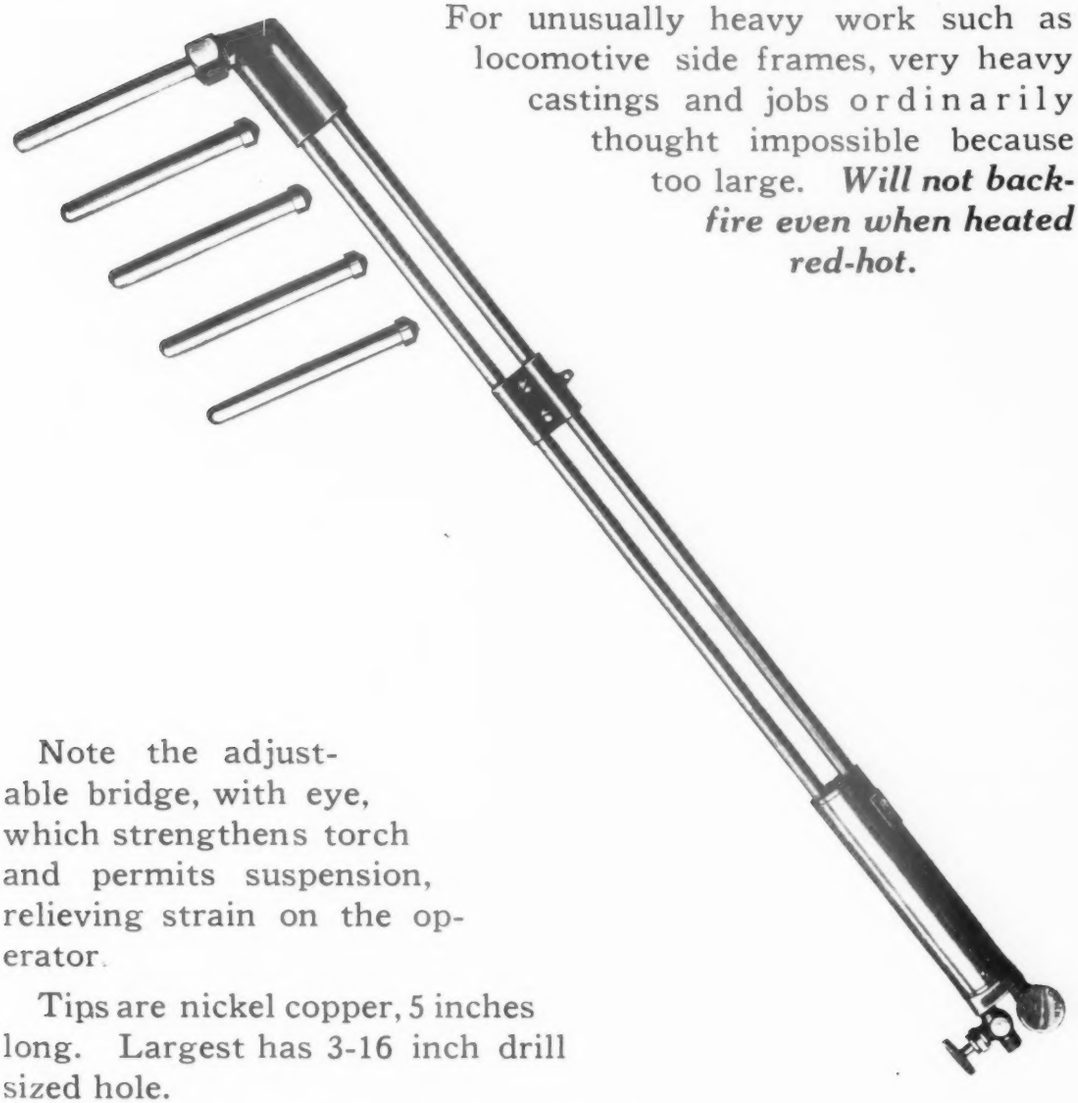
THE BASTIAN-BLESSING CO

D CUTTING APPARATUS

REGO

REGO MODEL "LL" WELDING TORCH

For unusually heavy work such as locomotive side frames, very heavy castings and jobs ordinarily thought impossible because too large. ***Will not back-fire even when heated red-hot.***



Note the adjustable bridge, with eye, which strengthens torch and permits suspension, relieving strain on the operator.

Tips are nickel copper, 5 inches long. Largest has 3-16 inch drill sized hole.

Price, Model "LL" Torch, with 5 tips.....$55.00

COMPANY, West Austin Avenue at La Salle Street CHICAGO

REGO

show as a very faint line. This shows that in cooling the metal in the good weld stretched considerably, whereas in the poor weld there was not sufficient strength to permit of the metal stretching.

Welding Cracks in the Throat Sheet of Boiler.

Cracks often form at the throat sheet. They usually begin at the water side. A great many consider it impossible to successfully weld cracks of this kind, and yet the writer knows thoroughly competent operators who are doing this with entire satisfaction.

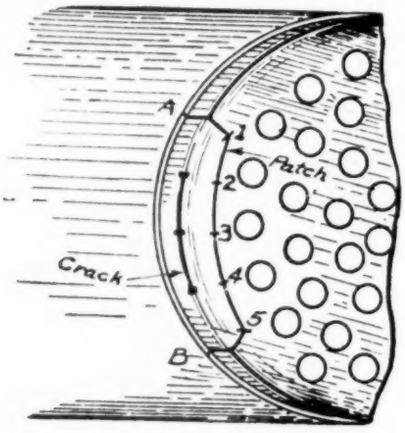


Fig. 61.

The work must be carefully done and the weld reinforced for about 1 inch on both sides of the line of the weld and beyond the end of the crack, and when finished, heated in the same line for some distance each end of the weld. Where possible the weld should be made on both the water side and the outside, but one side alone will do.

Welding Cracks in Side Sheets Extending Through Stay Bolts.

Considerable trouble has been experienced in the welding of cracks in sheets that extend through several stay bolts. This trouble can be largely overcome by carefully following the directions as to preparation and at the same time making a good weld. Fig. 49 shows a crack extending from stay bolt No. 1, through No. 2 and as far as No. 3. This cut shows the crack and the stay bolt holes beveled as is always done in preparing for welding. From a $\frac{3}{8}$-inch thick plate cut three discs, each about $\frac{1}{4}$ inch smaller in diameter than the hole, beveling the edges and attach by welding to the center, an ordinary piece of welding wire. (See. Fig. 50.) Place

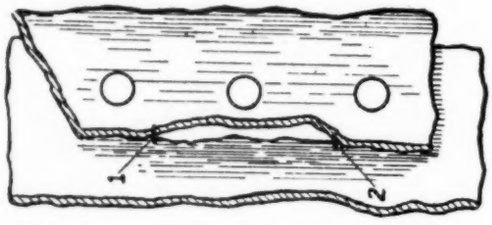


Fig. 62.

the disc in the center of the hole and "tack" it in position and then burn off the rod. Then weld the disc to sheet, filling it up until flush with the sheet. When this is done, heat at XXX "A," Fig. 49, and allow the heated portion and the weld to cool together. When cool, start at hole No. 2 and weld in like manner as before and continue by welding the crack from No. 2 to No. 1.

Immediately start welding up hole No. 3, finishing the crack from No. 3 to No. 2. When completed, heat at XXX "B" and let cool. If the crack could be examined from the water side, in all probability a number of small cracks would be found running parallel to the main crack. When the contraction strains of the weld set in, one of these small cracks might open up unless the weld is reinforced or built up about $\frac{1}{8}$ inch higher and made 2 inches wide, which should always be done.

Welding Cracks in Bridges of Flue Sheet.

Where one or two cracked bridges appear, recourse to a patch is not necessary. In Fig. 51 we show bridges cracked

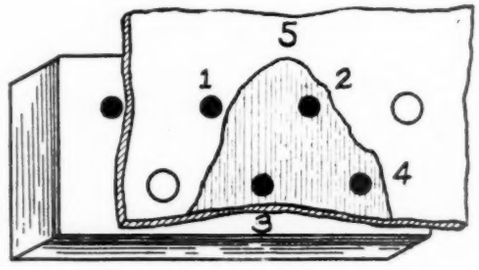


Fig. 63.

at No. 1 and No. 2. The cracks should be prepared by beveling, but the open space at the bottom need not be quite so wide as in the case of preceding welds, $\frac{1}{8}$ inch being sufficient. A No. 6 tip should be used with $\frac{3}{16}$-inch welding wire. It is preferable to make the weld from the water side, using an extra welder on the fire box side to work in conjunction with the head welder. Build up the weld about $\frac{3}{32}$ inch heavier than the sheet. For either weld No. 1 or No. 2, we start the work by heating the bridges marked "X" and then proceed with the weld. When the welding is finished again heat the bridges marked "X."

Welding Patch in Center of Flue Sheet.

The writer is an advocate of the triangular patch and where a number of cracks or erosions appear in the bridges of the flue sheet, it is advisable to use a patch and not try to weld each individual crack. Fig. 52 shows a portion of a flue sheet that has had the cracks cut out and a triangular patch fitted in ready for welding. The preparation as to beveling, size of welding tip and wire is the same as for a crack.

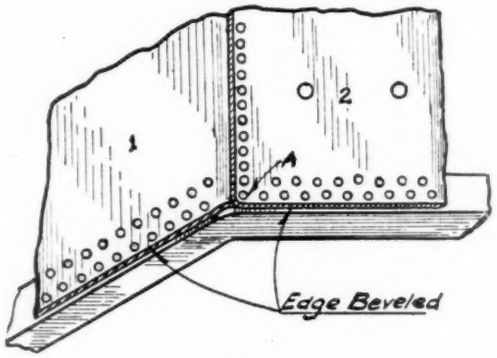


Fig. 64.

Before starting welding, heat each corner and also the bridge marked "X." Then weld the bridges No. 1 and No. 2, No. 3 and No. 4 and No. 5 and No. 6, and again heat the corners and the bridges marked "X." Then weld the bridges No. 7, No. 8 and No. 9 and continue in this manner until the patch is entirely welded.

Welding Patch at Top of Flue Sheet.

Where the cracks or corroded places appear at the top

of the flue sheet and are so bad and of such an extent that a patch is desirable, it is advisable to include the knuckle. In Fig. 53 we have shown such a patch fitted and ready for welding. Ordinarily we would prefer the triangular patch, with the bottom of the "V" at No. 1, but it is always desirable that the operators know how to make more than one kind of a patch. The flue holes should be put in as shown, the edges beveled and the size tip and welding wire used as indicated in the preceding articles. If possible, make the weld from the water side, using another welder on the opposite side. We start by welding the bridges No. 1, then

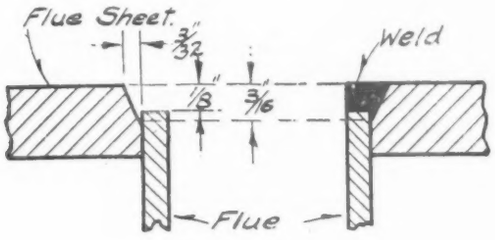


Fig. 65.

jump to No. 2 and weld towards No. 1, then to No. 3, finishing at No. 1; then from No. 4 to No. 2 and from No. 5 to No. 3 and continue in this manner until the welding of the bridges is completed at No. 8 and No. 9. The operation is completed by welding the flanges No. 10 and No. 11.

Double Mud Ring Patch.

The first mud-ring patch that we will describe is one that is made to take in both sheets and is known as a double mud-ring patch. Fig. 54 shows such a patch and it is important that it should be shaped exactly as indicated in the cut. It is fitted in position and riveted to the mud-ring, omitting the rivets next to the weld. Edges are to be beveled as usual, leaving

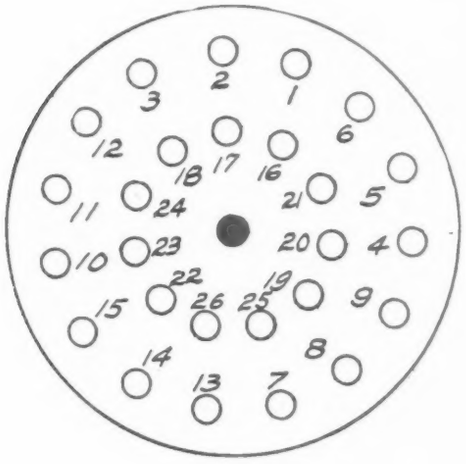


Fig. 66.

a 3/16 inch opening at the bottom of the "V." Start the welding at mud-ring "A" and when this is finished move to No. 2 and weld to No. 1. Then move to No. 3 and make the flange weld and when this is completed, continue the weld to No. 2. Proceed in like manner with the sections No. 4 to No. 3 and No. 5 to No. 4. The final weld is at the mud-ring "B."

Mud Ring Patch Extending Around Fire Box.

In Fig. 55 we show a patch fitted into position in which the patch extends around three sides of the fire box. The legs or ends of the patch can be made to take in a part or the entire length of the side sheets as occasion requires. It is preferable to taper considerably the ends No. 2 to "A" and No. 9 to "B," although not absolutely necessary. Edges are beveled as usual and patch laid off into sections of about 8 inches or 10 inches as indicated in sketch. We first weld the mud-ring at "A" and then start at No. 2 and weld to No. 1. If this part of the patch is on a considerable taper, we can immediately start welding at No. 3 and work back to No. 2, but if the taper is rather abrupt, the weld at No. 2 to No. 1 should be allowed to cool to take care of the shrinkage, before starting at No. 3. When this weld is made, jump to No. 4 and weld to No. 3 and continue in this manner until completed.

Welding of Door Collars.

For this job, the first thing to do is to lay off the door sheet so that when it is cut one row of stay-bolts will be around the door collar as shown by the black dots in Fig. 56. The cutting torch should be used. Bevel the edges as usual, leaving a 3/8 inch space at the bottom between the sheet and the collar. A corrugation should be put around the collar, to allow for shrinkage when cooling. (See Fig. 57.) Use 3/8 inch or 1/4 inch welding wire and a No. 6 welding tip. Lay off the collar into sections of about 6 inches to 10 inches, depending upon the size of the collar, the larger engines naturally taking the longer sections.

We first weld the section No. 2 to No. 3 and when finished heat the corrugation; then start on the opposite side and welding from No. 6 to No. 7, always heating the corrugation and adjoining after finishing the weld. We next weld section No. 4 to No. 5 and heat corrugation; again start on the opposite side and weld section No. 1 to No. 8 and heat corrugation. Then weld sections No. 1 to No. 2, No. 5 to No. 6, No. 3 to No. 4 and No. 7 to No. 8 in the order given, always heating the corrugation after finishing each weld.

It is best to reinforce the weld so that it is somewhat thicker than the sheet.

Welded Door Holes.

In Fig. 58 we show a door hole laid off into sections preparatory to welding. The edges of the two sheets should be beveled and prepared for a butt weld, although there are some who use a lap weld. By the time an operator is sufficiently proficient to do this class of work he certainly knows the difference between a butt and a lap weld, but if there is any doubt in the matter, Fig. 17 on page 122 shows a butt weld and Fig. 19, page 123, shows the lap weld.

For door holes the butt weld is preferable. If instructions are followed, no shrinkage troubles will be encountered. Use 3/8 inch or 1/4 inch welding wire and build up weld thicker than sheet.

To start this job we first make a "tack" about 1 inch long at No. 1 and then jump to No. 2 and weld back to No. 1. Lift the torch and start at No. 3 and weld to No. 2 and continue in this manner until the section No. 5 to No. 4 has been completed. We now start at No. 8 and weld to No. 1, and then section No. 7 to No. 8, No. 6 to No. 7 and No. 5 to No. 6.

Welding Horizontal Crack in the Knuckle of Flue Sheet.

A crack that is frequently met with is one in the knuckle of the flue sheet. In Fig. 59 we show such a crack running horizontally, which should be beveled so as to have a "V" of 90 degrees, cutting out the metal at the bottom of the "V" so as to leave an opening or clear space of 3/16 inch. Lay off the crack into sections of about 8 or 10 inches as shown in cut. Use same size welding tip and wire as in ordinary boiler work. When possible, it should be welded from the water side.

Commence by heating the sheet beyond the crack at XXX No. 1. When about a red heat, start welding at No. 1, making a weld of about 1 inch where beveled and extend the weld over the unbeveled sheet at XXX for a distance of 1 or 2 inches. When this is done, jump to No. 2 and weld to No. 1, then to No. 3 to No. 2 and No. 4 to No. 3 and finish by heating at XXX No. 4. Build the weld up so that it is

somewhat thicker than the sheet itself and at the same time make the weld at least 1½ inches wide.

Welding Vertical Crack in Knuckle of Flue Sheet.

In Fig. 60 is shown a vertical crack in the knuckle of the flue sheet extending from a flue hole to the crown sheet. This is extremely simple. Bevel as you have been instructed in all of preceding work and start welding the crack at the flue hole, working towards the crown sheet. Weld from the water side.

Welding Patch in Flue Sheet.

In Fig. 61 we show a crack that has been cut out and a patch in place ready to weld. Patch is beveled and fitted. We start welding at No. 1 and work towards "A." When the flange at "A" has been finished, start at No. 2 and weld to No. 1, then No. 3 to No. 2, No. 4 to No. 3, No. 5 to No. 4, finishing the work by welding the flange "B." No trouble should be experienced.

Welding a Caulking Edge.

In Fig. 62 we have tried to show an edge that has been cut away by continued caulking, corrosion or by the action of leaking steam.

The first thing to do is to thoroughly clean the metal where the edge is to be built up. Scrape off all the rust and scale on the sheets around where welding is to be done and use a chipping hammer on the eroded edge. Then make the weld, building up the metal somewhat heavier than the sheet and when through, take a four-ounce hammer and lightly hammer the weld until nice and smooth.

Building Up Corroded Place Near Edge of Sheet.

In Fig. 63 we show in the shaded portion, a corroded place near edge of sheet at the mud ring.

In preparing, clean the corroded place and the sheet near same thoroughly of all scale, rust, etc., and take out rivets No. 1, No. 2, No. 3 and No. 4. Start welding at No. 5, working towards the bottom edge. Build up slightly higher than sheet and use a hammer lightly afterwards.

Welding Sheet to Mud Ring.

Considerable of this class of work is being done, but it requires an experienced and careful welder to do successful work, for the reason that the mud ring is so much heavier than the sheet, the inexperienced will too frequently fail to get the mud ring in a molten state, with the result that proper adhesion is lacking. Use at least a No. 8 welding tip and see that the mud ring is brought to fusion before adding metal from the filler rod. The edges of sheets No. 1 to No. 2 (Fig. 64) which are to be welded should be beveled and the mud ring must be cleaned of scale and rust at and near the weld. Start welding sheet No. 1 and when lap at "A" is reached, weld up the seam for about 6 inches and then come back and finish the beveled edge of sheet No. 2.

Welding Locomotive Flues.

The sheet should be prepared by counter-sinking the flue hole about ⅜ inch deep and extending the flue to within ⅛ inch of the outer surface of the flue sheet. If this is done, the flue will extend about ⅜ inch beyond the lower edge of the counter-sinking. See Fig. 65. Do not use copper ferrules. Expand the flue just enough to fill up the flue hole. Use ⅛-inch welding wire and No. 5 welding tip.

For the individual weld, start at the bottom or lower side and make one-half of the weld, stopping at the top of the flue. Then begin again at the bottom and make the other half of the weld.

For welding a number of flues, Fig. 66 shows the order in which they should be welded, beginning at No. 1 and continuing in numerical order, finally finishing at No. 26. This distributes the shrinkage strains.

THE BUILDING FIELD.

For the past two years building and construction in the United States has been at a standstill. Because of the shortage in labor and construction materials contractors and builders have done but very little. It is believed that the situation will now improve very rapidly, and as an illustration of the work which is in sight the following figures are presented. While the construction of a large building does not in itself involve very much welding (it will some day), yet the prosperity of the building, contracting and steel fields will surely be reflected on the welding industry.

Figures obtained by F. W. Dodge Co. from canvass of about 400 architects' offices in New England, the Middle Atlantic States and the Middle West.

City or District	Number of Offices	Total	Industrial & Office Bldgs. Number	Industrial & Office Bldgs. Total	Apartments, Hotels, Residences Number	Apartments, Hotels, Residences Total	Institutional, Church & Municipal Number	Institutional, Church & Municipal Total	Unclassified
N. Y. City	91	$79,575,000	22	$22,420,000	11	$11,065,000	22	$32,305,000	$13,785,000
Buffalo	14	3,693,000	2	970,000	2	1,648,000	1	1,075,000	.....
Newark	8	4,255,000	1	3,080,000	1	655,000	1	520,000	15,386,000
Boston	12	19,816,000	1	175,000	1	395,000	2	3,860,000	.....
Worcester	7	1,920,000	1	805,000	1	210,000	1	905,000	.....
East. Mass. except Boston	17	3,855,000	1	770,000	1	1,515,000	1	1,570,000	.....
Maine & N. H.	8	1,400,000	1	175,000	1	375,000	1	850,000	.....
Connecticut	9	6,089,000	1	1,845,000	1	782,000	1	3,462,000	.....
Philadelphia	42	42,724,000	14	14,968,000	13	13,724,000	14	14,032,000	.....
Trenton & Camden	11	3,955,000	1	675,000	1	145,000	1	3,135,000	.....
Eastern Pa. except Philadelphia	15	4,215,000	1	1,195,000	1	400,000	2	2,620,000	.....
Baltimore	18	4,200,000	1	615,000	1	1,105,000	2	2,480,000	.....
Pittsburgh	42	15,410,000	3	3,675,000	1	5,860,000	1	5,875,000	.....
Cleveland	19	34,450,000	1	7,500,000	2	2,250,000	2	24,700,000	.....
Columbus	2	3,535,000	1	2,525,000	1	250,000	1	760,000	.....
Cincinnati	6	2,005,000	1	525,000	1	100,000	1	1,380,000	.....
Chicago	42	144,047,000	12	128,033,000	1	1,929,000	1	14,085,000	.....
	363	$375,144,000	64	$189,951,000	37	$42,408,000	52	$113,614,000	$29,171,000

THE INTERNATIONAL ACETYLENE ASSOCIATION.

The annual report of the International Acetylene Association has been issued. In issuing the report the secretary, Mr. A. Cressy Morrison, says:

"I am sending you under separate cover a copy of the annual report which has been very much delayed by war conditions, and has been materially reduced in size in order that the cost to the association might be brought to within reason. At the same time, the publication, issued in its khaki cover as a reminder of the war, will probably mark one of the greatest periods in the history of acetylene.

"Acetylene, both as an illuminant and as a fuel gas, has certainly done its bit in the war, from the depths of the coal and metal mines to the far-flung battle fields of France, the brilliant rays have served vitally necessary purposes. In the munition plants, in the railroad shops, in the repair bases and wherever armies have moved, acetylene cutting and welding torches have been of vital importance. This is the first war in which acetylene has had an opportunity to serve and the service has been great. We may indeed feel a well justified pride in our industry."

Mr. Morrison also issues the following announcement:

"The United States Chamber of Commerce called together a Reconstruction Congress at Atlantic City, December 4th, 5th and 6th. Many business men gathered and the conclusions reached represent the concensus of opinion regarding present business and industrial conditions.

"The matter is of such importance that every member of the association will find much of interest in studying the report. The complete report is to be published by the Chamber of Commerce publication, known as the 'Nation's Business,' and as the International Acetylene Association was represented, the best possible report to the members is the publication above referred to. For this reason, you will in due course receive a copy which is most respectfully commended to your attention."

Left to Right—E. W. Reynolds, Chicago; R. W. Hume, Journal of Acetylene Welding; D. N. Hood, Indiana; J. W. Carnrick, Kansas & Oklahoma; Representative Naval Training Station—Great Lakes; Representative large Steel Co., Chicago; R. S. Wilson, Chicago; R. O. Mueller, Chicago; C. E. Shaw, Detroit; Representative of a Steel Co., Chicago; J. N. Harkins, Office Manager, Minneapolis; J. R. Wilson, Detroit; H. Bird, Chicago; C. F. Williams, Chicago; E. F. Kane, Chicago; W. R. Noxon, District Mgr., Chicago; L. B. Mackenzie, The Welding Engineer; F. J. Maeurer (sitting on steel plate), Supt. D-B Co.'s Shop, Chicago; Small Boy, Kenneth Mackenzie, Editor in the Making, The Welding Engineer.

DEMONSTRATION OF AUTOMATIC CUTTING MACHINE.

Radiograph Demonstrates Its Efficiency at Chicago Shops of the Davis-Bournonville Co.

An interesting exhibition of the remarkable flexibility and efficiency of the Radiograph was recently given at the

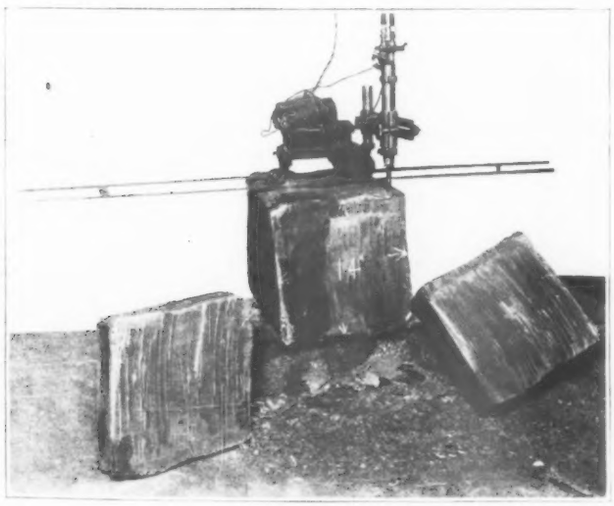


Fig. 2. Cutting 14"x14" Billet.

Chicago Shop of the Davis-Bournonville Co., the purpose of the demonstration being chiefly for Davis-Bournonville salesmen in Western territory.

The first demonstration was the cutting of a block or billet of steel, fourteen inches square. Two cuts were made, both of which were smooth and clean. There were 392 square inches of cutting and the time required was 13 minutes. 200 cu. feet of Oxygen and 20 cu. feet of Acetylene were required. The Oxygen pressure was 170 pounds and the Acetylene pressure 6 pounds. The cost of the two cuts, without labor, was $2.90, or $0.007 per square inch. The tip used was 3-10 Style 35. These cuts are shown in Fig. 2.

The Radiograph was also used to demonstrate the cutting of bevels, with an extension arm attachment. The plate used was 1¾ in. steel. The length of the cut was 48 in. and the time was 6 minutes. 40 cu. feet of Oxygen were used and 8 cu. feet of Acetylene. The tip used was a 3-BC, Style 25. Oxygen pressure used was 80 pounds, Acetylene pressure 4 pounds. This cut is shown in Fig. 3.

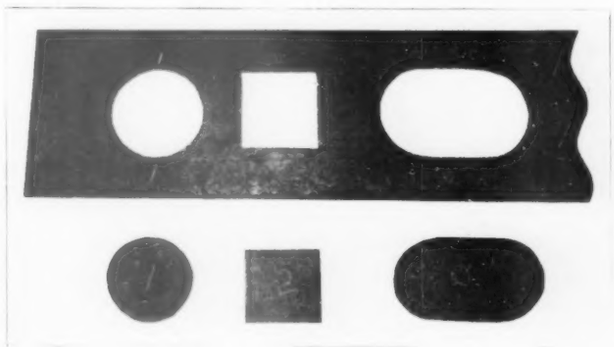


Fig. 5. Cutting Shapes.

Fig. 4 shows the Radiograph with an extension arm attachment, being used to cut squares in a ¾ in. steel plate. The size of this square was 16x16 inches and the time required was 8 minutes. Oxygen consumed was 24 cu. feet and the Acetylene 5 cu. feet. Oxygen pressure used was 40 pounds, Acetylene pressure 3 pounds. The tip used was a 2-3, Style 25.

Fig. 5 shows round, square and oval holes cut at the demonstration, with a scallop cut at the left hand of the sheet. The circle was 18 inches, the square 16x16 inches

Fig. 3. Cutting Bevels.

and the oval 18x30 inches. The time required was 5 minutes for the circle, 8 minutes for the square, 7 minutes for the oval and 4 minutes for the scallops.

Zig-zag cutting can also be accomplished with the Radiograph, using an extension arm.

Fig. 6 shows a powder can welded with the Radiograph. These cans were made in large quantities for the Government by the Fred Medart Mfg. Co., St. Louis. The length of weld is 69 in. the diameter of the can being 11¾ in. The can is made of 14 gauge sheets. It reguires 3½ minutes for each seam and the tip used is No. 3, Style 2414.

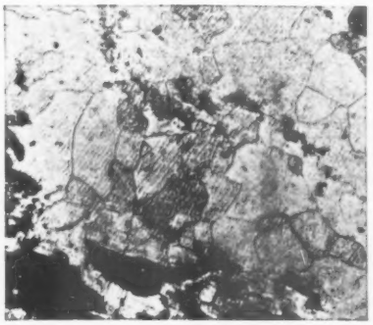
Fig. 6. Powder Can Welded in Radiograph.

After welding a plunger is forced through to make the cylinder absolutely straight and smooth inside, as the Government's requirements only allowed the manufacturers 5/1000's of an inch, plus or minus. The can is then subjected to an air pressure of 5 pounds and must be absolutely tight. Cylinders of greater length and of varying diameter can be welded similarly on the Radiograph.

The National Welding Council meets in New York City this week. Matters of great importance to the welding industry will be discussed.

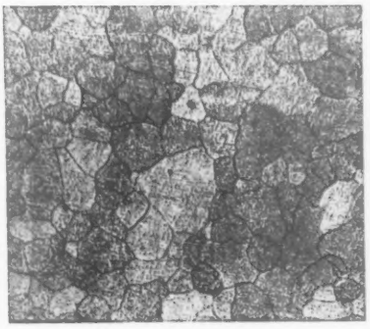
Fig. 4. Radiograph with Extension Arm Attachment Cutting Squares.

The microscope shows why ARMCO IRON is by far the best filling material for welds



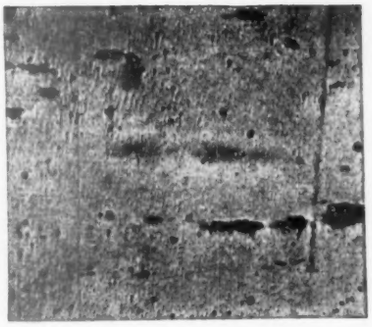
Charcoal Iron

The black spots indicate slag and impurities detrimental to the welding operation and the strength of the weld.



ARMCO IRON

Clearness and evenness of the grains indicate uniform density, purity and freedom from occluded gases.



Open Hearth Steel

The black and muddy spots indicate gasses and blow holes. The lack of individual grains is due to impurities.

The above micro-photographs (70 diameters magnification) show for ARMCO IRON an improvement in density, uniformity and purity, that can be secured only by the American Rolling Mill Company's process of steady and progressive elimination of defects.

Before ARMCO IRON is sold as such, microscopic and chemical analysis of samples from various parts of split ingots must show practical freedom from occluded gases (see lower pictures), slag, sulphur, silicon, manganese, phosphorus, carbon, copper, arsenic, and other detrimental impurities.

The first requisites of good welding qualities are purity and homogeneity—purity to assure ready and thorough union between the filler and the solid metal; and homogeneity to assure uniform holding strength throughout the finished weld.

The high purity, homogeneity and extremely fine grain of ARMCO IRON are conceded by every prominent metallurgist who has made tests.

These superior characteristics of ARMCO IRON make possible the use of a single metal composition, drawn in two tempers, one for oxy-acetylene and the other for electric welding, to meet every requirement of steel and iron welding.

A trial of ARMCO IRON Welding Rods will quickly demonstrate their convenience and reliability, and our engineers will help you to get the best results.

Stocks carried in all large industrial centers.

ARMCO IRON

Part of ingot sawed in half to show the uniformity and the practical freedom from blow holes.

Steel

Part of split ingot showing typical blow holes and uncertain density.

The trade mark ARMCO carries the assurance that iron bearing that mark is manufactured by the American Rolling Mill Company with the skill, intelligence and fidelity associated with its products, and hence can be depended upon to possess in the highest degree the merit claimed for it.

PAGE STEEL & WIRE CO.

Established 1883 as Page Woven Wire Fence Co.

Makers of "Copperweld" Copper Clad Steel Wire; ARMCO IRON Welding Rods and Electrical Wire; Wire Mill Products, Plain and Galvanized; Wire of Special Analysis; Wire Fencing for all Purposes; Factory Gates; Ornamental Iron Fence; Machine Guards; Tool and Stockroom Partitions; Architectural Iron.

PLANTS: Monessen, Pa. and Adrian, Mich.

SALES OFFICES: 30 Church Street, New York

WESTERN REPRESENTATIVES: Steel Sales Corporation, Chicago

29

MEPHISTO ALTERNATING CURRENT ARC WELDER.

The Arcwell Corporation, 42 Broadway, New York City, has recently placed on the market an arc welding outfit which operates on alternating current, and therefore does not require a motor generator set. In this welding outfit, alternating current is taken from the line and transformed to a low voltage suitable for arc welding. The regulation of the welding current is obtained by means of a special transformer consisting of three cores so connected that magnetic flux is automatically shifted from one core to another as the current tends to vary, due to the variation of the length of arc as the operator's hand wavers.

Another feature of the outfit pointed out by the maker is the short length of arc used. Owing to the method of winding the transformer, the operator is compelled to hold a short arc, that is, one that is not over $\frac{1}{8}$ in. long. It is claimed that this length of arc will not produced an oxidized or "burned" weld. It is said that a 150-amp. outfit of this design is suitable for welding all work from $\frac{1}{32}$ in. thick to the heaviest casting, and will operate satisfactorily with either bare or coated metallic electrodes. Suitable terminals are brought out for quickly adjusting the welding current from 75 amp. to 175 amp. A cutting tap is also provided.

For use with carbon electrodes for foundry work, where rapid filling of blow holes is essential, two of the 150-amp. transformers may be connected in multiple, giving a capacity of 300 amp. with approximately 70 volts across the arc. As the primary and secondary windings are entirely separate, the welding circuit may be grounded without affecting the line.

These machines are made in different sizes, ranging from the 75-amp. set for garages to the 600-amp. set for heavy foundry work. The standard primary voltages are 220, 440 and 550; however, the standard frequencies are 25, 40 and 60 cycles. Inasmuch as the power cansumption is low, 4 kw. for the 150-amp. set, the machines are built single-phase. It is said that on two three-phase circuits the unbalance caused by the welder is less than that caused by a 5-hp. single-phase induction motor.

ELECTRIC WELDING SCHOOL CLOSED

Dec. 23, 1918.

Mr. L. B. Mackenzie, President,
"The Welding Engineer",
608 So. Dearborn St.,
Chicago, Ill.

Dear Sir:

You may be interested to know that in the readjustment of the Emergency Fleet Corporation, we are abandoning all our electric welding training activities for the shipbuilders. We are, therefore, closing down our training centers in Schenectady, Brooklyn, Cleveland, San Francisco and Philadelphia.

The report made by Captain (now Major) James Caldwell of the British Army has now been exhausted, and our distribution is therefore complete.

Due largely to your very kind services in commenting upon this report, we are still receiving applications for further copies. I would appreciate it very much if you would insert a note in the next issue of your paper, advising your many readers that this report has become exhausted by the heavy demands made upon us, and that there will be no further issue of this report, due to the fact that this organization is now closing up its activities. I think you will agree with me that this explanation is a worthy consideration, due to your wide circle of readers, and it would assist us, in, that closing up this organization, there will be no one left to make the proper replies to the many requests.

Permit me to take this opportunity to thank you for your kind consideration in our work during the period of hostilities, and the splendid manner in which you aided us, both in propaganda and also in putting before the public the fundamentals of what I trust may be a new industry in the commercial developments of our country.

With very kind personal regards, and compliments of the season,

Very truly yours,
H. A. HORNOR,
Industrial Relations Division,
by H. A. Hornor,
Head, Electric Welding Branch,
Education and Training Section.

EYE PROTECTION.

A recent Government Bulletin contains the following:

"Although some manufacturers insist that the welder who wears goggles is not subjected to eye strain, it is more generally admitted that there is danger even with this protection. The following statement is made by the Engineering Department of one of the leading companies manufacturing oxy-acetylene apparatus:

"Acetylene welding, or any other work in strong light, should not be undertaken except by people with thoroughly normal eyes. Any original weakness or irritation will be enhanced to some extent by constant exposure to strong light. On the other hand, experiments conducted for us by Professor M. F. Weinrich of Columbia University, have shown that with properly tinted spectacles or goggles, no injury will occur to the eyes of the operator originating from a strong light."

In commenting on this statement, Professor Otto Koppins, of the Ryerson Physical Laboratories, University of Chicago, says:

"There is no doubt that strong light should be avoided, at any rate, eyes do not feel comfortable in it, as we experienced when looking into the sun. There is no doubt that in using the oxy-acetylene flame, and looking at it with the eyes unshielded the condition is not normal, and some sort of disturbing effects result. Outside the volume or intensity of light, which is a personal matter, since some people feel perfectly comfortable in light of a certain intensity which would make other people feel uncomfortable, there is the question of short light waves coming. Normal eyes are so constructed that they can only perceive the light which is contained between rather narrow limits, that is from the longest red to the shortest violet. In other words we see only the light waves from about 7000 to 4000 Angstrom units, a rather small part of the whole spectrum. The longer waves are heat waves, and do not affect the eye in any other way except in intensity. But the shorter waves are the dangerous ones, since they are the chemically active rays, which will affect the eye on that account besides on account of their intensity. Just what the effect is depends upon the intensity and length of exposure. A relatively short exposure causes burns on the skin such as are caused by the sun, in fact sun burns are produced by the short rays in the sun light. Prolonged exposure would, of course, cause more severe burns, and since, of course, the operator usually takes precautions when he is warned, the extreme effects are not known. It is safe to say, however, that the

(Continued on Page 46)

WELDING SPECIALISTS

Leading Welding Shops of the United States, equipped to handle unusual and difficult welding and cutting work. We send men anywhere and guarantee work. Prices reasonable. Correspondence solicited.

Rochester Welding Works

We not only do welding, but supervise the design and installation of oxy-acetylene welding plants; report on welding material and methods; make tests on welding apparatus for efficiency and economy.

Nine years' experience.

Rochester Welding Works
349 Orchard St., Rochester, N.Y
S. W. MILLER, M. E., Proprietor

WE weld broken machinery and auto parts. Aluminum crank cases a specialty. Welders and brazers of all metals. Custom welding for the trade. Let us figure on your requirements. Imperial Brass Mfg. Co., Welding Dept., 508-510 S. Racine Ave., Chicago, Ill.

Davis-Bournonville Co.
147 W. Austin Ave. Chicago

Davis-Bournonville Co.
Marion Jersey City

Davis-Bournonville Co.
316 Penn Ave. Pittsburgh

Texas Headquarters for Welding and Cutting. The Best Equipped Plant in the State.

Southern Welding & Machine Co.
212-14 College Street
San Antonio, Texas

ONE of the largest and best equipped job welding shops in the United States. Our men are experts. No job too large or too complicated. Work guaranteed—prices reasonable.

When in trouble send for our man

Torchweld Equipment Co.
Fulton and Carpenter Streets, Chicago

Space in this department costs $20 per inch per year. For instance, the space occupied by the Imperial Brass Manufacturing Co., costs $20 for 12 issues.

This is a directory of America's best welding shops.

The Welding Engineer

Reg. U. S. Pat. Office.

Published on the 15th of Each Month by

THE WELDING ENGINEER PUBLISHING CO.,

608 S. Dearborn St., Chicago, Ill.

Telephone Wabash 7134.

L. B. Mackenzie.....President and Editor

Subscription payable in advance and postage free.

United States, Canada and Mexico.....$2.00 a year

Foreign Countries ..... 2.50 a year

Single copy, domestic .....20 cents

Single copy, foreign .....25 cents

Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

The Welding Engineer is a member of the Audit Bureau of Circulations

Eastern Office:

171 Madison Ave., New York. Telephone, Murray Hill 4394.

Max I. Barth, Eastern Representative.

The Welding Engineer in Australia and New Zealand.

The Welding Engineer in Australia and New Zealand.

Mr. E. Hill, Matlock House, Devonport, Auckland, New Zealand, is our accredited representative in Australia and New Zealand for obtaining new subscriptions.

VOLUME 1. JANUARY, 1918. NUMBER 1.

Learning to Swim.

WE never shall forget the circumstances under which we learned to swim. A large, husky, brutal Uncle pitched us into deep water without any preliminary conversation.

We paddled right out—and the water was deep.

The welding trade was sort of pitchforked into the War, or rather the War was pitchforked into the welding trade. We had been talking for a long time about the need of welders in industrial circles, but nothing much was done about it. Then along came the war and—bingo—we have as many little welding schools as there are little acorns.

We were recently asked to hazard a guess as to how many men the Army and Navy had passed through welding schools and we "guessed" somewhere between two and three thousand. The most of the boys who took a Government course, however, need good old experience, and they are only slightly more advanced in the trade than the several hundred girls and women who worked on munition work during the War.

But on the whole we confidently expect to see the welding trade paddle right out of the difficulty into which the shortage of *real* workers has pitched us.

Advertising the Job Shop.

AS we pointed out in a previous issue of *The Welding Engineer*, many welders do not attach sufficient importance to photographs of interesting and unusual welding jobs. Such photographs, if used properly, would bring business into the shop and greatly stimulate business. The nation is just beginning to realize what conservation means.

About Ourselves.

WE don't like to talk about ourselves, but it's a raw deal American trade papers got in the way of Second Class Postal Rates. If it had not been for American technical papers our war preparations would have dragged—there wouldn't have been any Chateau Thierry.

Most assuredly trade paper publishers were not getting rich—but on the other hand they were playing a very important part in the education of America's best manhood. So why make it hard for them to distribute information?

So if you dont receive your *Welding Engineer*, don't blame us, but write Colonel House or the Postmaster General. We can't keep you on our list unless you "kick in" with the coin.

Sometime in the near future this subject, Second Class Mail rates, is coming up for discussion at Washington. If you believe in making it easy to secure good, helpful and instructive trade papers, write a letter to the fellow who sends you the garden seeds (that you don't want).

Business Conditions.

THE office of the leading trade paper in any given field is usually the weather bureau for that particular field. When business is good the Editor knows it and when it's bad there is simply hell to pay.

So far as we can see the ending of the War has caused no change in the situation of the welding trade, unless it's for the better.

We think that's because the art of welding might be compared to the spindly legged young lady who suddenly takes on long skirts and the mannerisms of her elders. You see, she grew.

A couple of years ago the art of welding was a wall-flower. Since then we have "growed" up and have become very attractive and popular.

In the past two years our charms have been brought forceably to the notice of many a man who looked straight at, through and over us a while back. War did a plenty for us. Let's buy 5th Liberty Bonds when they spring them.

Test Your Welds.

NOT long ago *The Welding Engineer* conducted a series of welded specimens, the welds being made by readers of *The Welding Engineer* in all parts of the United States and Canada.

The results were very disappointing. Out of over 100 pieces of 2x½" ordinary tank steel we secured but four real good welds. This must not be taken to mean that the percentage of faulty welds is exceedingly high, because most of our test welds were made by welders who possessed very little experience.

In some instances, however, poor welds were made by experienced welders and in these instances we credit the poor work mostly to carlessness and cocksuredness.

Even the old welder will do well to inspect his welds from time to time. Mose assuredly a foreman of welders should test the work of his welders frequently.

The Welding Engineer.

BEYOND a doubt the growing prestige of *The Welding Engineer* is as much due to the splendid constituency that reads it and has had faith in it since the beginning, as it is to the person who has been directly responsible for its conduct. We think our success has been in a large measure a reflex of the broad gauged character of the men in the welding field.

A growing industry demands a good paper and in a nutshell that's the reason for *The Welding Engineer*. In three years we have grown remarkably and are still going great guns.

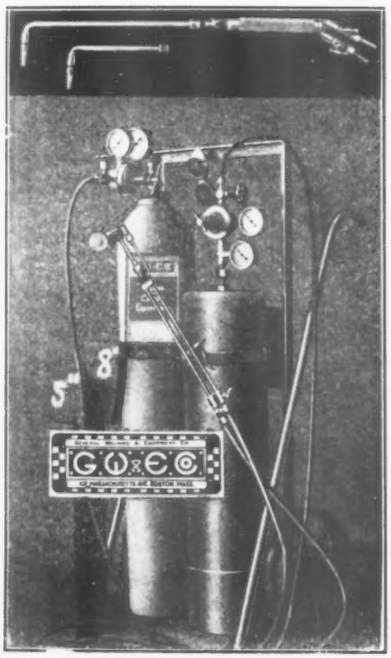
For our part we shall try to make *The Welding Engineer* better and more useful this year. It will be our task to give our readers the product of the best welding brains in the United States.

In this work we are so fortunate as to be able to announce that we shall be assisted this year by several gentlemen whom we regard as being at the top of the welding ladder. These gentlemen will contribute to *The Welding Engineer* during 1918 and we feel sure our readers will benefit from their writings. The welding authorities to whom we refer are: M. Keith Dunham, F. J. Maurer, S. W. Miller, C. J. Nyquist and P. F. Willis. We feel this is a jury to whom it would be safe to refer all welding problems.

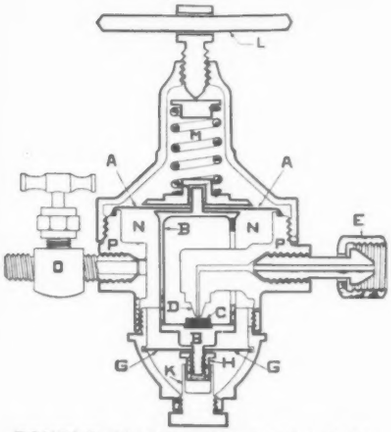
These contributions will begin to appear with the February issue and will continue throughout the year.

GENERAL WELDING & EQUIPMENT CO.
G.W.&E.CO.
107 MASS. AVE. BOSTON, MASS.

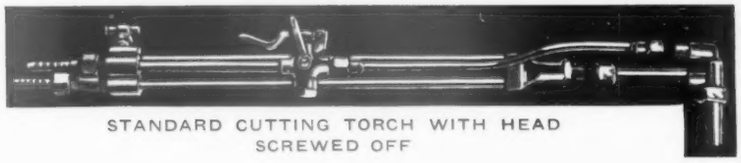
STANDARD WELDING AND CUTTING EQUIPMENT



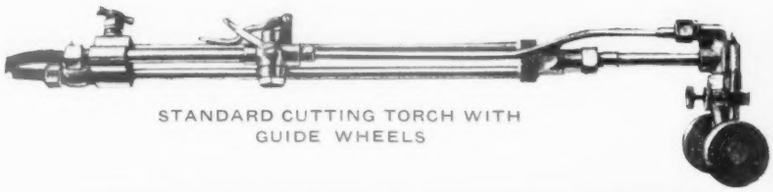
STANDARD WELDING AND CUTTING EQUIPMENT
$175.00



DOUBLE DIAPHRAGM REGULATOR
Perfect, forcible, frictionless alignment; differential spring action produced by the double diaphragm (A and G) system; quick, sensitive and reliable regulation.



STANDARD CUTTING TORCH WITH HEAD SCREWED OFF



STANDARD CUTTING TORCH WITH GUIDE WHEELS

STANDARD WELDING TORCH WITH 3 EXTENSIONS, TO HAVE EITHER A 16 IN. LONG TORCH OR A 22 IN. OR A 30 IN. LONG ONE.

DESCRIPTION:

1. REGULATORS are of the double diaphragm system, that is to say, the movable centerpiece B carrying seat C is not only tightly fastened to main diaphragm A, but also with fitting H to rear diaphragm G. Thus seat C is forcibly guided and restricted to an absolutely straight up and down movement, keeping always the same relative position to nozzle D. The rear diaphragm acts as a forcible and frictionless guide and also as a quick acting double way spring enforcing an accurate and sensitive regulation.

   NO OTHER REGULATOR HAS THESE ESSENTIAL FEATURES.

2. WELDING TORCHES consist of a torch base with 2 extensions to have either a 16-inch long torch or a 22-inch long one, giving you practically two torches in one. A third extension may be added to have a 30-inch long torch. Thus one torch with its 9 tips is sufficient for all possible requirements.

3. CUTTING TORCHES are second to none in efficiency, economy and endurance. Everything is of the most modern open construction. Each part can be reached and inspected without delay. The picture on top shows a torch with the head separated from its base. By loosening two screws the whole head comes off, showing how easy it is to exchange even a complete head.

   MANY THOUSANDS ARE IN CONSTANT USE.

4. Everything in our constructions is easily accessible and exchangeable. With carrying a few spare parts you can do your own maintaining even in far away countries.

GET OUR CATALOGUES

Future Trade Prospects.

THERE is no reason to be pessimistic over the future of the industry. The large privately owned machine shops of the world are greater today than ever before. Their machinery is badly worn. Railroads in every country are needing equipment of every kind. The shelves of the world were never so barren. Shops of Belgium and northern France must be rebuilt; the coal and iron mines of France must be restored; the textile mills of Belgium must be re-equipped; sugar mills all over the world must be repaired; new roads must be made, and not an item of machinery required for these industries can be constructed without the aid of machine tools. What we need is a definite governmental policy looking toward a protection of machine tool prices, augmented, of course, by a great selling organization of the machine tool industry itself. With these assured, within a year the machine tool industry of America will enter again on a prosperous era.

The basic laws of all exporting, when conditions approaching normal arrive again will apply to tools as well as to any other product. That America can compete in its manufactured products with Europe seems to be certain. We still have a distinct advantage in our method of manufacture over other countries. On account of her great domestic market, America has been able to develop manufacturing specialists.

Another thing which the war taught America is the necessity of selling abroad from stocks on the ground. We cannot expect to compete without them. Extension of credit is another important factor, and, whereas we used to demand cash for our goods, we must in the future grant longer terms of credit than ever before. Thanks to the growing organizations of some of our biggest American banks, this will be perfectly convenient and possible.

Extremely important, too, is the necessity for crating our export shipments in the smallest possible space and in the most substantial manner. In hundreds of reports reviewed from all parts of the world, giving rules to follow in exporting, the main point of caution is in the manner of boxing. The Government, too, in its great over-seas shipments during the war, has been so impressed with the necessity of proper boxing and crating that it has issued a bulletin on the subject.

Following this, of course, is the matter of packing lists, containing necessary information to enable the foreign customer to get goods through customs without delay and at the lowest possible cost. In a great measure, American shippers have learned many things about exporting during the war. The necessity for maintaining an export trade will quickly place the basic rules of exporting beside the multiplication table in the intellect of American business. The need now is one of service, and no people in the world will go further to give real tangible and satisfying service to customers, when they once know what is wanted, than the people of America.

The matter of exchange is also important from the standpoint of export business. Exchange simply means the value of the currency of one country in terms of currency of another. If the United States dollar is worth more than i normal value at any particular time, it means that your goods will cost your customer more in his own currency in proportion. This often puts the manufacturer at a disadvantage, and, unless his agent has some means of disposition of the native currency which is paid, other than by converting it immediately into dollars, native manufacturers can greatly undersell. This problem will, of course, be materially simplified when America begins to buy great quantities of foreign merchandise for delivery to all markets of the world. It will enable us to virtually trade in commodities, using exchange merely as a convenient expression of value. This will be possible when our merchant marine plying all waters of the globe.

If we will study the methods employed by the two greate merchant nations of the world before the war—England a Germany—we will find that England built up her great fo eign business through merchant shipping and investment money in foreign countries in industries that formed pe manent markets for her merchandise. Germany obtained her foreign business through merchant shipping and salesmen combing every market of the world.

America, due to her growing merchant marine, and also to the fact that she is now the greatest creditor nation i the world, is in a position to combine the two methods above described. She will have to furnish means to rebuild the devastated regions of Europe. Her credit will be sought in South America and the Orient. Her growing merchandising firms even now are engaged in the task of extending their selling organizations to all markets of the yorld. Her ships are rapidly growing in number and, provided our seaman's lanes are amended to match with those of other countries, will soon be entering all ports of the world.

Before the war, strange as it may seem, the bulk of America's exports was controlled by foreigners. Several of the European countries, recognizing Americans provinciality in the matter of the sale of her products, came to America and formed export houses of their own to sell American goods abroad. One such house did an annual import and export business with South America totalling $30,000,000 a year. Others obtained the exclusive selling rights of American manufacturers in the most important foreign fields.

When the war began, many manufacturers in this country, therefore, found their sales organizations in many of the best foreign markets completely destroyed. Then, and only then, did it dawn upon this country how dependent it was upon foreign export houses and sales agents for its export trade. The situation might have proved disastrous for much of our export trade had not the war assumed such gigantic proportions as to tax the manufacturing capacity of the entire world. The great demand for almost everything—machinery especially—afforded our manufacturers the opportunity to make new selling connections. The great expansion of the manufacturing capacity, which also followed, has, however, been fully equalled in the other belligerent countries; and protective measures of all kinds will be established to give their industries every possible advantage, to assist them in paying off their foreign debt.

TIGHT ARC WELDS ON THIN METAL.

An interesting report was published elsewhere in the December issue, covering the welding of a special sheet metal tank. This test was made for the purpose of determining the suitability of the closed-circuit system in England for building gasoline tanks for use at the front. It was entirely successful, and seemed to the representative appointed for the task to be an extraordinary performance in arc welding. Mr. Otis Allen Kenyon, Chief Engineer, Arc Welding Machine Company, Inc., New York, directed the tests.

A-B-C of Oxy-Acetylene Welding
By L. B. Mackenzie

The series which runs in this issue may be secured in reprint form, by chapters, at a very low cost.

Here's Economy—

In Price—In Operation

This Torch
With Nine Tips
$30.00

Smith's Welding Torch No. 2

—is the lowest priced high-grade torch made. It is economical in operation,—operates perfectly on only two pounds oxygen pressure.

It is simple and easy to operate. Because of the low pressure under which it operates, it gives a soft flame that will not blow the metal. It will not flash back.

Note the comfortable grip which fits the operator's hand. This, together with the perfect balance of the torch, prevents fatigue.

Smith No. 2 Welding Torch, 14", 18" or 22" size, with nine tips	$30.00
Smith No. 3 Welding Torch, same as the No. 2, including sizes and tips, but with right-angle head	$30.00
Cutting Head for above torches will cut to two inches of steel	$ 3.50
Welding Tips, brass, each	$ 1.15
Welding Tips, copper, each	$ 2.00

We also manufacture the Smith Welding Torch No. 1 (the celebrated "Pistol Grip") and Smith's Generator. Write for full information.

Manufacturers

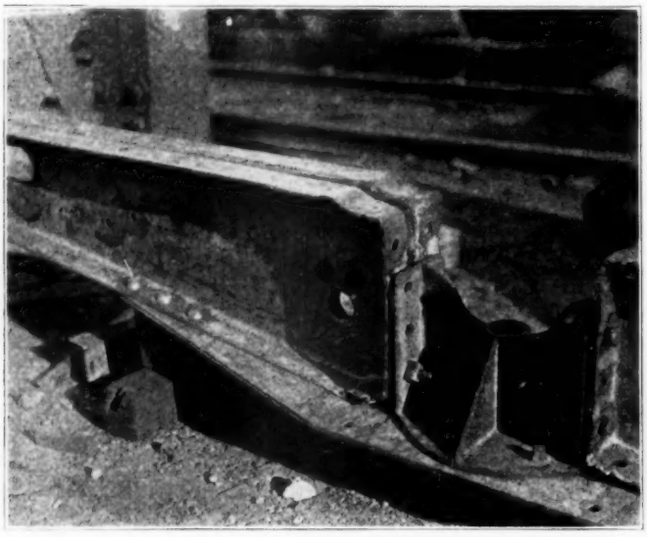
We have an attractive proposition to offer manufacturers who do a large amount of welding and cutting and need several torches or generators. Tell us your needs and write for details.

Smith's Inventions, Inc.
Dept 1 Minneapolis, Minn.

ELECTRICALLY WELDED GONDOLA CAR.*

Car Constructed for C., B. & Q. R. R. Offers Precedent for Welding Hulls of Steel Ships.†

The proposal by the Emergency Fleet Corporation to substitute electric welding for riveting in the fabrication of hulls for steel ships has served to turn a certain amount of thought to the matter of applying the same methods in the construction of steel freight car equipment. Instead of the fleet corporation's serving to point the way to the car builders, however, it so happens that the initiative in the matter lies with the car builders, this from the fact that as long as 1911,



Bottom Tie Plate Welded to Body Bolster Diaphragms. Rivets Shown Are for Attachment of Side Bearings.

Welding Floor Plates to Bolster Diaphragms.

Welding Splice Plates and Top Chord Angles on Gondola Car Built for C. B. & Q. R. R.

Spotwelds in End of Completed Car.

the American Car & Foundry Co. out of a lot of several hundred steel drop bottom gondola cars built for the Chicago, Burlington & Quincy R. R., fabricated one of the cars, as an experiment, by electric spot welding employing the means and attaining the results shown in the illustration herewith.

At the time this work was undertaken electric spot welding was by no means in common use and the practical limit of commercial equipment then available was two ⅜-inch plates. It was therefore necessary to design a complete new apparatus capable of handling plates of the thickness used in steel car construction. This work was undertaken by Joseph A. Osborn, an electrical engineer with the above named car builders, who succeeded in building a machine capable of welding a ¾-inch core through plates assembled in thickness up to 2¼ inches. The machine, as illustrated, consisted of a structural steel frame with a 66-inch throat, having a recess for the accommodation of an 85-kilowatt transformer and arranged for 440 volt primary circuit and a 25-volt secondary circuit. Electrodes were of copper three inches in diameter with the welding points reduced to ¾ of an inch. Regulation of the primary circuit was effected by means of taps in the primary winding to supplement which, a choke coil also was employed. Combinations of these two agencies afforded a satisfactory means of control. In the original design, as shown in the illustration, pressure was applied to the work through the medium of a hand-wheel

Reference to what is believed to be the pioneer attempt at fabricating a steel freight car structure by process of electric welding. Of especial interest at this time because of the action of the Emergency Fleet Corporation in applying electric welding methods on a large scale in ship construction.

CANADIAN CARBIDE

MORE GAS PER POUND

CARBIDE SIZES

Medium	3½" x 2"
Small	2" x ½"
Nut	1¼" x ⅜"
Pea	¼" x ½"
Miners' Special	⅝" x ⅝"

· *Packed in* ·

1000 Lb. - 100 Lb. *and* 25 Lb. *Drums:*
10 Lb. - 5 Lb. - 2 Lb.
1 Lb. *Tins.*

Send for Booklet with this cover

ALABAMA
Bessemer, 2014-2024 Second Av.

ILLINOIS
Belleville.

INDIANA
Rochester.
Terre Haute, 15 North Eighth St.

IOWA
Albia.
Centerville.
Knoxville.

KENTUCKY
Beaver Creek.

LOUISIANA
New Orleans, Camp & Commons Sts.

MARYLAND
Baltimore, 101 Light St.
Emitsburg.
Westernport.

MASSACHUSETTS
Boston, 47 Oliver St.

MICHIGAN
Detroit, 343 Bellevue Av.
Saginaw, 204 Forester Temple.

MINNESOTA
Duluth, 3rd Av. East & Michigan St.

MISSOURI
Joplin, opposite Postoffice, Lexington.

NEW JERSEY
Paterson, 61-63 Washington St.

NEW YORK
Buffalo, Seneca & Hamburg Sts.
Cortland, 41 Elm St.
Malone, 32-34 W. Main St.
Middletown, 28 W. Main St.
New York City, 30 Church St.
Springville.
Trumansburg, 55 Main St.
Valley Stream.

OHIO
Barton.
Crescent.
Maynard.
Nelsonville.
Salem.
Toledo, Address Detroit.

OKLAHOMA
Commerce.
Tulsa.

PENNSYLVANIA
Avonmore.
Barnesboro
Clymer
Hastings.
Latrobe.
Nanty Glo.
Pittsburgh, 520 Farmers Bank Bldg.
Portage.
Pottsville, Centre & Market Sts.
Saltsburg.
South Fork.
Wilpen.

RHODE ISLAND
Providence, 546 Charles St.

TENNESSEE
Knoxville, 761 Asylum Av.

TEXAS
El Paso, 323 S. Santa Fe St.

UTAH
Salt Lake City, 121 W. 2nd South St.

VERMONT
Burlington, Park Av.
St. Johnsbury.

VIRGINIA
Onley.
Richmond, 1319 E. Main St.

WEST VIRGINIA
Bluefield, 200-206 Railroad Av.
Charleston, 821 Virginia St.
Clarksburg, 603 Goff Bldg.
Huntington, 1032 Third Av.
Matewan.
Morgantown.
Northfork.

CANADA CARBIDE SALES CO.
INCORPORATED

Exclusive Sales Agents for

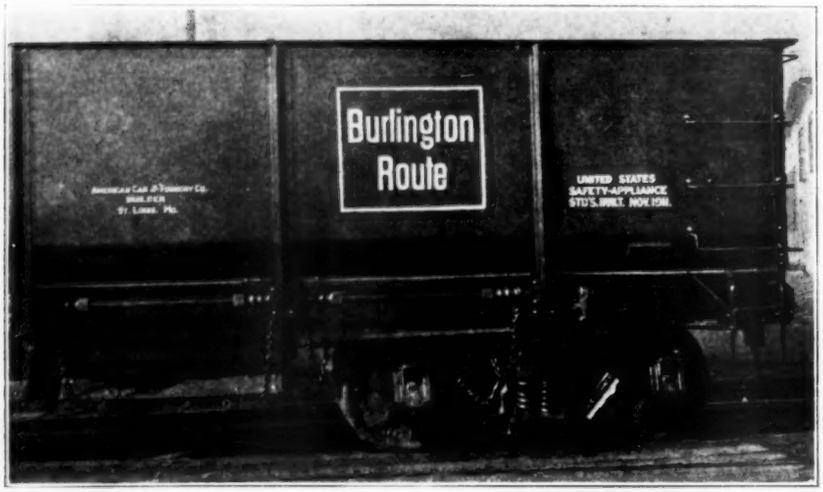
CANADA CARBIDE CO.
Montreal, Quebec.

Works
Merritton, Ontario. Shawinigan Falls, Quebec.

General Offices
30 Church St., New York

and screw, this arrangement being supplanted by an air cylinder device which, of course, was more convenient and permitted faster operation.

The apparatus having been perfected to a satisfactory extent, the welding of the car was undertaken. Owing, however, to the inaccessibility of some of the connections and to the use of a considerable number of castings, as in the case of the door, hinges, etc., only about 85 per cent of the fabrication was effected by means of the welding machine, rivets being resorted to for the remainder. In the underframe, welding was used on the center sill and cross bracer



Side Stake and Top Chord Welds.

cover plates and in the end sill and the body bolster assemblies. With the exception of the ladder irons, it not being desired to risk human life by attaching them by a process admittedly experimental, the entire superstructure was assembled by the spot welding process.

In taking up the work, the men detailed thereto become adept in the use of the machine in very short order. To such extent was this the case that it was estimated that at least one-third of the time otherwise required to put the car together had been saved, along with which was the saving in wear and tear on the tools and machinery ordinarily used in punching and reaming rivet holes to say nothing of the wasted power entailed in the operation of these tools through the medium of compressed air and the expense involved in replacing broken drills and reamers and the maintenance of the compressed air machinery. A study of the work led to the conclusion that the actual power requirement by the new means of car fabrication had been reduced to about one-third of its former value.

By way of testing the completed car, it was given a 150 per cent load during which it was shown to be a very rigid structure and developed no permanent set. In the seven years' service to which the car has been subjected since the time of its building, the car has made a very creditable record as is evident from the fact of its being an experiment without precedent and the further fact that it still continues in every day service.

The success attained by Mr. Osborn in this venture and his continued interest in the possibilities of electric welding in this and similar lines of work, has attracted the attention of the Emergency Fleet Corporation for which he has developed a number of spot welding machines of large capacity for use in ship construction.

From the Railway Review.

IS WELDING A TRADE?

Editor:

I just finished reading the article by Mr. Johnson, as to whether or not welding is a trade. As for my part I think welding is a trade, and furthermore a vital one. I have been in the game for the past seven (7) years. For two (2) years I traveled for the Burdette Mfg. Co. as a salesman and demonstrator. I have recently been with the Davis-Bournonville Co. here in St. Louis.

I have been in close contact with conditions in the line of getting competent men, and I must say that if some steps are not taken to weed out the good welders from the amateurs this most important industry is going to lose caste where it should predominate. I have never been able to find a man who could learn this trade within any reasonable time. In fact, it takes over a year of very hard work on a man's part to accomplish anything. Even in order to do this, he must be interested far beyond his weekly pay-envelope.

Another thing which occurs to me is the fact that there should be two organizations; one for welding and one for cutting, allowing of course the welders to do cutting when necessary, but barring the cutters from welding, until they have qualified for that work. It would take careful investigation to determine whether or not an applicant would be qualified to admission into either organization.

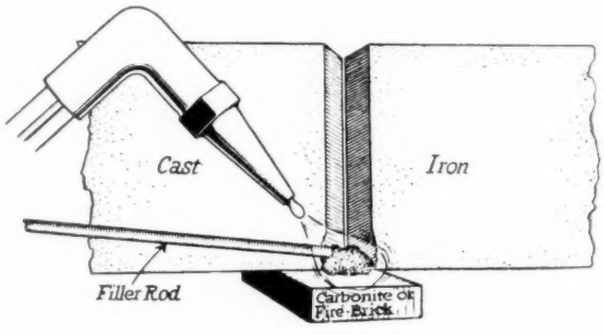
C. E. Hobbs.

A B C OF OXY-ACETYLENE WELDING.

By L. B. Mackenzie.

Chapter 5—Vertical Cast Iron Welds.

It is only during the past few years that vertical welds have become common and easy to execute by the average welder. Cast iron passes beyond the adhesive state when it reaches the melting point, and as it has a most decided tendency to flow, it



is of course difficult for a beginner to make an angle or a vertical weld without considerable experience.

To make an angle or vertical weld on cast iron the welder should start his weld at the bottom of the break and work up. If this is not done the molten cast iron will run down through the crack or groove and, the metal not being properly fused, make an unreliable weld.

It is possible for a skillful welder to execute a successful vertical weld without using either carbon blocks or other fire-resisting substances for retaining purposes. This is done by

Fyber-Weld GOGGLES for Welders

Fitted with "Essentialite" Lenses

Frame is made entirely of vulcanized fibre, and in addition to being light in weight is a non-conductor of heat and electricity, is non-inflammable and infusible, is not affected by moisture or perspiration and is easily sterilized and kept sanitary. Has flexible leather center, ventilated side pieces and adjustable elastic headband.

Prices as follows:

No. 510, fitted Essentialite lenses, No. 4 shade, for cutting and cover glasses	$3.00 pair
No. 510, fitted Essentialite lenses, No. 6 shade, for welding and cover glasses	$3.00 pair
No. 510, fitted with amber, smoked green or deep blue, cesko blue and cover glasses	$2.50 pair
Extra cover glasses in clear or amber tint	.20 pair

"ESSENTIALITE" LENSES

To those of our patrons who are not thoroughly conversant with the real qualities and benefits of "Essentialite" lenses, we take pleasure in furnishing the following information. In placing the "Essentialite" before the trade, we have, after years of experimenting and research, succeeded in discovering the means of protecting the delicate organism of sight against the destructive Ultra Violet rays. We have demonstrated conclusively that with these lenses we vanquish the so-called "fatigue weariness" and headaches caused by Ultra Violet and Infra Red rays.

Manufactured By **CHICAGO EYE-SHIELD CO., 2300 Warren Ave., Chicago, Ill.**

WANTED

Subscription Men for The Welding Engineer

Write me. **L. B. MACKENZIE**
608 S. DEARBORN STREET CHICAGO

BOOKS ON WELDING

Write for list of books on welding.
If it's in print we have it.

THE WELDING ENGINEER
608 S. Dearborn St. CHICAGO, ILL.

A-B-C of Oxy.Acetylene Welding

By L. B. Mackenzie

Any part of this series may be had in pamphlet form in qauntities, at cost. Write for special prices.

The Welding Engineer

ELECTRIC WELDING

By ERIK OBERG

A Practical Book on This Important Subject and One That Embodies the Results Obtained and the Methods Used by the Most Prominent Concerns in the United States.

295 Pages, 6x9 Inches, 213 Illustrations

PRICE, $3.50

Electric welding has become so important an art in the mechanical industries that a comprehensive treatise on this subject covering both the resistance and the arc welding processes is needed in the trade. A special study of the subject has, therefore, been made by the authors of this work, who have been assisted in their work by the experts in resistance and arc welding of some of the most prominent concerns in the United States engaged in this line of work.

Consultations with the experts of these companies have made it possible to obtain thoroughly up-to-date information embodying the latest developments and discoveries in the art, and it is believed that, for this reason, the book will prove especially useful to those who are already employing electric welding equipment or who are contemplating its use, as well as to the students of the subject who desire to obtain authoritative information on the electric welding processes.

CONTENTS

Electric Welding Processes—Electric Resistance Butt-Welding Special Butt-Welding Machines and Processes—Electric Spot-Welding—Seam-Welding and Riveting—Percussion Welding—Electric Soldering—Principles of Electric Arc Welding—Applications of Electric Arc Welding—Welding Transformer Tanks by Electric Arc.

"Electric Welding" is splendidly bound in green cloth. It is fully illustrated with cuts and engravings and gives in its 295 pages exactly the data and information on electric welding that the man in the machine building plant requires.

THE WELDING ENGINEER 608 S. Dearborn St. CHICAGO

WELDOX

Asbestos Welding Paper

Send for a Free Sample

It's especially made for you—for the welder, not for the casting. Not the ordinary paper manufactured for many uses, but a scientifically prepared, long-fibre, pure asbestos paper developed for one purpose—to furnish a welding paper capable of withstanding hard usage and high temperatures without giving off noxious and injurious smoke, gases and fumes. Your men naturally can do better work when WELDOX Asbestos Welding Paper is used on every welding job.

WELDOX Asbestos Welding Paper comes in 50 lb. and 100 lb. rolls, 36 inches wide.

Test the Free Sample with a torch. Subject it to physical tests. "WELDOX" in your shop and available for every job will save in many ways: It lasts longer; it cuts out eye and lung sore for the welders; it therefore aids in turning out better work in less time.

Asbestos Mittens, plain.
Asbestos Mittens, reinforced.
Asbestos Mittens, plain, one finger and thumb.
Asbestos Mittens, reinforced, one finger and thumb.
Asbestos Mittens, rivet faced.
Asbestos Mittens, 23-inch length over all.
Asbestos Gloves, 5 fingers.
Asbestos Leggings, 16-in. to 30-in. length.
Asbestos Aprons, made to specifications.
Asbestos Masks.

Write for Sample Now.

F. D. Farnam & Co.
F. D. FARNAM G. E. HARVELL
140 South Dearborn Street Chicago, Ill.

"dropping", but greater speed and security may be had, with corresponding success, by using carbon to start a vertical weld, as illustrated in Fig. 26.

Carbon products are made in several forms for welders—carbon plates or sheets in varying shapes and sizes, carbon rods and carbon paste. Without these products many of the fine welding operations during the past two years would be impossible.

Fig. 27 illustrates a type of broken casting which is to be welded

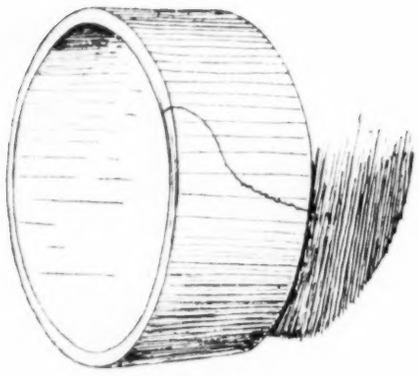


Fig. 27

with the aid of carbon plates. This weld would be very simple if the casting could be turned, but for the sake of illustration let us assume that the casting is immovable. If this was the case it would be necessary to devise some means of arresting the flow of metal during the welding operation.

To repair a break of this kind the crack is V'd out as previously described, to a 45 degree angle. A fire brick furnace is then constructed, in accordance with previous instructions, and then carbon blocks are carefully fitted into the V'd out crack, notched and numbered and laid aside, to be placed in position as the weld progresses. The fire brick furnace, showing

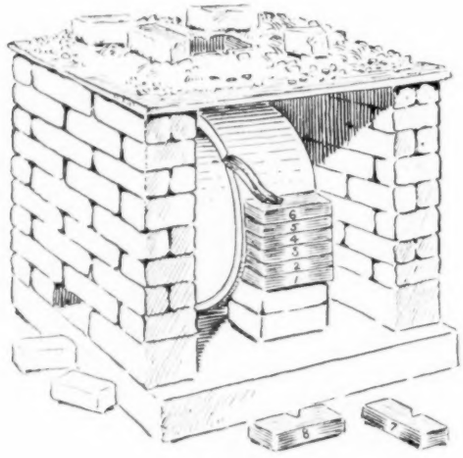


Fig. 28

the casting with the carbon blocks in position, is shown in Fig. 28.

Carbon block No. 1 is first placed in position and the welding operation begins. When the metal added to the V reaches the top of the first carbon plate block No. 2 is placed in position, and so on until the entire V has been filled.

Carbon blocks are superior to fire bricks or fire clay or any other home-made combination of fire resisting substances. When carbon blocks are used, properly fitted to the break, little, if any, machining is necessary. As a rule the welded seam is smooth and regular. The carbon blocks are not a dead loss, as they may be used again and again. Carbon blocks may be had in a variety of sizes, from 3/16" to 2" thick, as wide as 6 inches and in lengths up to 30 inches. They are also supplied in blocks 12"x12". Another valuable product for the welder is carbon paste. This paste is a carbon mixture which at ordinary temperature is plastic, but which becomes as hard as carbon block when it is heated. This carbon paste is very useful, for instance, when the line of the weld passes through holes, which it is desired to preserve, or when the welder wishes to preserve a thread. The hole is filled or the thread covered, which protects it from the flame. Carbon paste is also used when broken gear teeth are being built up, although carbon blocks, properly shaped, are preferable as shown in Fig. 29. Carbon paste may be used as a mould or a dam, to hold molten metal in place. Carbon rods are used chiefly as cores to save redrilling holes that otherwise might be filled with metal during the welding operation. They come in all sizes, from 3/8" to 2" in diameter and from 12" to 24" in length.

Carbon in general is a highly refractory material, has a very low co-efficient of expansion due to heat, is mechanically strong and can be obtained in many shapes and sizes.

In welding a piece of cast iron, approximately 3 inches thick, where the break is V'd out from one side only, a block of carbon should be placed as shown in Fig. 26. If a fire brick is used care should be taken to select one with a smooth surface, otherwise the molten cast iron will penetrate the cavities of the brick, making it difficult to clean off the surplus metal.

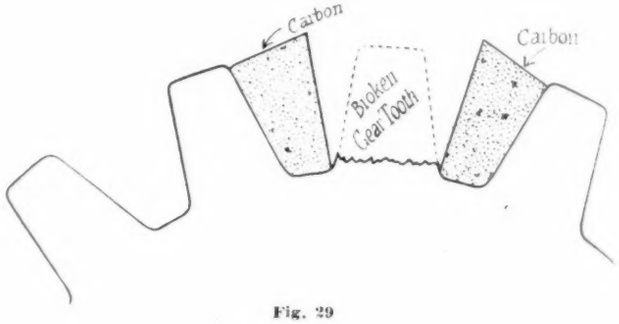


Fig. 29

The metal is then melted out of the V in the usual manner, flux being added to promote the flow of metal over the form joining the lower edges together. Care should be used in building the outer edges of V, otherwise the metal may run away.

The operator should watch the flow of metal carefully. Form the outer edge of weld first and then puddle and form the inside of weld.

Make sure that the surface of weld is high enough, as it is very difficult to build on more metal after the weld is finished.

If it is difficult to control the metal it is because you are either holding the torch too close to the weld or the torch is in the wrong position to control the metal. It is safe to finish the weld a little high, as it is a very easy matter to melt or "wash off" the surplus metal. In the case of a long vertical weld this "washing off" process should be employed at least every few inches, otherwise when the welder startsc to melt down the surplus metal at the top of the weld the cooler metal in the part of the seam first welded will chill the washed metal, causing blow holes.

When you introduce a welder to The Welding Engineer you do him a favor. There is no "come-back," he gets his money's worth.

OXY-ACETYLENE AND ELECTRIC WELDING*

By A. F. Dyer, General Foreman, Welding Department
Grand Trunk, Montreal.

With the present price of material, scarcity of labor and difficulty of obtaining steel and iron, welding and cutting by both the electric and oxy-acetylene processes has proved to be a great help and an almost indispensable factor in railroad repair shops.

Seven years ago the Grand Trunk employed one man as an acetylene welder and owing to failures through his lack of experience, the process was nearly condemned, but as we gathered experience both gas and electric welding developed, so that now instead of one man we employ eighteen and often work them overtime.

The low pressure acetylene gas system is used and the whole shops are piped for the acetylene, every other repair pit having a drop connection. In roundhouses we use Prest-O-Lite dissolved acetylene in cylinders which saves the expense of a generator and piping where the process is only in use occasionally.

There are many kinds of electric welding outfits on the market. Our new equipment using alternating current instead of direct current, weighs only 150 pounds, gives from 20 to 200 amperes, and is about 50 per cent cheaper than any direct current machines. The outfit consists of two generators each operating four welding circuits. A panel control allows each man to change current independent of the other welders.

Both of these methods of welding have proved themselves fit to be ranked amongst the greatest time and labor savers introduced on the railroads for a long period. For instance, not long ago a locomotive with a broken frame would be held in the shops for several days as it would take some time for removing the frame, and having it welded in the smith shop, then machined and replaced. Now a frame 4 inches by 5 inches can be cut and welded in less than 14 hours. Frames when worn by brake gear and stays, are built up and worn holes are plugged and welded instead of reaming them out to a larger size and thereby weakening the frame.

The present price of tool steel demands that none shall be wasted, therefore we use it down to the last inch by welding it to tire steel. Twist drills, taps and reamers when broken near the socket end are welded and put into use again. For this purpose we use either the electric or gas process but in both cases we use vanadium steel filling rods, as we find this gives the best results. Spokes of driving wheels are welded and flat spots on tires have been successfully welded when it was necessary to do so.

Up to the present time we have not had much success welding cast iron with the iron electrode, although with the carbon a fair job can be done, but the gas is unquestionably the best for any of this work. We have successfully welded with oxy-acetylene, steam and shovel engine frames and cylinders by welding in patches of cast iron where worn or broken. When our contract for shells was completed and the lathes that were used for this purpose were being overhauled, it was found that most of the V-slide beds were worn by the tool carriers. These were built up by the oxy-acetylene process, which saved machining the beds down as much as $\frac{1}{8}$ inch in some cases.

In regard to boiler work, most of the welding is done with the iron electrode, using a mild steel or Swedish iron as a filler. It is found that the electric process localizes the heat more than the gas, though it is the writer's opinion that the gas makes a closer and neater weld, as all welds made by the electrode are more or less porous unless they are hammered. When patching a firebox it is better whenever possible to apply quarter or half side sheets in order to get the weld out of the fire. However, well a patch is welded, it generally gives out in from twelve to eighteen months' service, and the same applies to cracks, whereas the quarter or half side sheets should last as long as the firebox.

When a nest of small cracks is found round the stayboltts, the bolts are removed and the holes countersunk and welded. This method has been found to be very successful. Corner patches are welded by running the patch into the tube or back sheets, as the case may be, at the same time removing the flanges. If it is decided to do away with a number of tubes, plugs are welded in the holes. The holes are countersunk and the plugs are punched by a countersunk die which gives them the proper bevel for welding.

Superheater flues are being successfully welded to the tube sheet. The operators I am connected with prefer to have the flues belled and water in the boiler. This keeps the tube sheet from heating, especially around the smaller tubes. The tubes are set in with copper ferrules set back $\frac{1}{2}$ inch and the flues are belled out $\frac{3}{8}$ inch to $\frac{1}{2}$ inch; the small tubes, $\frac{3}{8}$ inch. The sheet is roughened all around the tubes and flues, and the oil is then burnt off with the oxy-acetylene flame and tubes and flues welded in with electrode, using $\frac{1}{8}$-inch mild steel or Swedish iron. The latter is preferred if calking is needed.

A sample of an average day's work is as follows, for a gang of 12 men:

- 11 rivet holes in smoke box and 4 peg holes in foundation ring.
- 10 tube holes in upper portion of firebox tube sheet.
- 2 air pipes which were worn through.
- In the tool room:
- 1 ratchet for jack (2 teeth replaced).
- 1 gear spindle built up.
- 1 chuck screw, key end built up.
- 1 boring shaft built up from 2⅞ inches to 2⅞ inches.
- 2 tool holders, rebuilt.
- 1 air hammer handle repaired.
- 6 teeth in lathe gear, built in.
- 1 cone, small end filled up solid.
- 2 1¼-inch holes in top rail of frame filled up.
- 4 cracks 18 inches long in right side sheet welded.
- 14 bottom tube holes welded up.
- 2 washout plug holes built up for re-tapping in round head.
- Cut out frame for welding and started welding same.
- Welded bushes in pony truck stys.
- Cut out 3 sets of boiler tubes.
- Cut out 1 set of superheater flues.
- Build up calking edge of first hole.
- Heated corners of tube sheet for closing.
- Welded broken superheater damper bracket.
- Built up reversing lever where worn.
- Built up 2 side rods where worn.
- Cut out 48 flexible stayholts in firebox.
- Welded 2 cracks in throat sheet.
- 1 broken flange of air brake cylinder.

In addition to this list two men are engaged continuously on cutting around the shops.

For cutting steel and wrought iron the oxy-acetylene process has practically no competitor, it being impossible with the carbon point to cut as fast or as fine and neatly as with the gas torch. For scrapping fireboxes and frames, the carbon point is cheaper to use if time is no object and labor is cheap.

The foregoing examples illustrate only a very small fraction of the uses to which the two methods of welding and cutting are being put in locomotive repair and machine shops, and fresh uses are being found for it every day. No roundhouse should be without an oxy-acetylene outfit, both for repair work and as a part of the wrecking outfit, and all

large roundhouses should have both processes, as they would pay for themselves over and over again.

In concluding, I would state that though there are many different opinions as to which is the best process, no shop is complete unless it has both equipments, although the gas has really the widest range.

Welding should not be treated as a side line of the machinists' or boilermakers' business, but should be treated as a trade in itself, as it really is, for it needs the entire concentration of a man's mind, careful study, plenty of practice and a conscientious man to make a welder.

Wherever possible a separate building or suitable space should be provided for bench work, and should be equipped with a suitable furnace for heating and annealing castings. There should also be plenty of floor room for charcoal fires for preheating cast iron jobs before welding.

Discussion.

The extreme value of both welding processes was admitted by all, but there was a decided difference of opinion as to the detailed performance of the work. In fact, most of the discussion hinged on the relative value of lap and butt welds in firebox construction.

It was generally admitted that complete fireboxes could be welded by either the acetylene or the electric process, and A. M. Barry, of the St. Lawrence Welding Company, claimed that a safe joint could be secured only by the use of the lap weld. He claimed for the lap weld a high factor of safety, increased stiffness, double strength and added safety, due to staybolts.

The majority of railroad men, however, favored butt welds because of uniformity in metal thickness, more flexibility to prevent staybolt breakage, and less chance of defective welds due to surface scale. With either process, however, attention was called to the absolute necessity of having careful and experienced welders and the need for training such men. It was also recommended that welds be hammered as they are built up.

The possibility of increased tube mileage due to welding was discussed and generally admitted, and Mr. Barry described the application of welded boiler patches with rounded corners, again recommending the lap weld. In response to a question he stated that in his experience the welding of manganese steel was not successful.

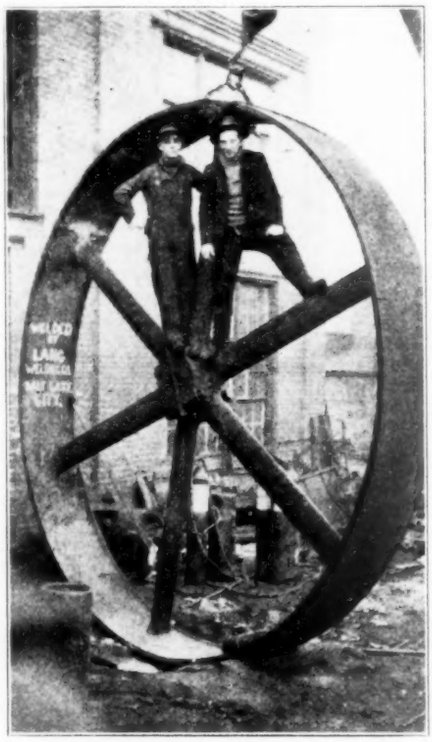
*Abstract of a paper presented before the Canadian Railway Club.

NEW ELECTRIC ARC WELDING APPARATUS.

A special apparatus designed to enable alternating current to be used for the cutting and welding of metals by the electric arc has been brought out by the Electric Arc Cutting & Welding Co., 222 Halsey Street, Newark, N. J. Any of the ordinary primary voltages of alternating current can be used as well as any of the standard transmission systems. As the machine can be taken directly to the point at which the work is to be done, if it is found desirable, the expense of wiring is consequently reduced.

The machine which can be supplied in three types for cutting, welding, and cutting and welding consists of a special transformer with no moving parts. An easily moved shunt in the magnetic circuit is provided to enable the operator to take care of conditions requiring different amounts of heat at varying temperatures. This is supplemented by a series of taps terminating in plugs on the top of the machine over which the terminals are slipped. As the complete 60-cycle machine weighs in the neighborhood of only 200 pounds two men can carry it to any location in the shop where work has to be done and place it on a bench or on the floor under the bench. Another point upon which emphasis is laid in connection with the portability of the machine is the fact that it will operate in any position either upside down or on its side.

The machine can be supplied for any voltage of alternating current although from the standpoint of safety a maximum of 650 volts on the primary side is recommended. Machines for operation on single-phase, three and four-wire, two-phase and three-phase power systems or across the outside wires of the two-



A Big Job Handled by the Lang Welding Co., Salt Lake City.

phase system can be supplied. In connection with the polyphase circuit it is recommended that a single-phase machine be distributed among the several phases to obtain an approximate balance of current, although a machine which will take power from a polyphase circuit and deliver single-phase welding current can be furnished.

EYE PROTECTION.

(Continued from page 34.)

result is similar to that caused by X-ray burns, which, of course, are much more severe and has cost the lives of careless operators.

These effects are those which occur when hands and face are exposed to these short light waves, as I have verified myself in connection with some of the experiments I am carrying on. Of course, that was not the main topic, I did not know that I was sunburned from ultra-violet light—till I was.

I don't know what the effect on the eyes would be, since I always wear goggles when adjusting the arc I am using. Most glass absorbs most of the ultra-violet light, altho I found in the case of the goggles I had been using that was not the case at all. However, your goggles show very clearly that they do absorb all of the short waves, and whatever the trouble due to the ultra violet light is, it would not enter if the source of light is viewed through your goggles.

Regarding eyestrain, that seems to me to depend upon whether or not the person has normal eyes or not. I cannot see why a person who wears goggles which have been ground to correct for the error in his eyes, or who wears goggles

Showing colored glass door open. Note that an inner glass door protects eyes from flying particles.

The Ideal Face Shield *for* Electric Welders

THE Ideal Face Shield is constructed of Aluminum and Vulcanized Fibre, resulting in durability and minimum weight.

The operator can easily open or close the door containing the colored glass, thus making it convenient for him to examine his work without removing Shield. When the door is open, an inner glass protects the eyes from any flying particles.

All glass can be removed and cleaned or new glass applied without the aid of tools.

The Ideal Face Shield is so designed that the glass is always in line with the eyes and the parts being welded.

The Ideal Face Shield can be adjusted to fit any operator.

No metal touches the face, therefore no possibility of a shock should any part of Shield come in contact with pencil-holder or parts being welded.

The Ideal Face Shield rests entirely upon the head, thus permitting the operator the free use of his head and arms at all times.

The Shield can easily be placed upon or removed from the head.

The Ideal Face Shield is so constructed that it is almost impossible for any light or reflection to reach the eyes from the sides or back; and a fire-proof apron protects the chest of the operator from the heat of his own arc.

The Ideal Face Shield can be found in many of the Railroad Repair Shops, Steel Mills and Shipbuilding Yards throughout the United States and Canada.

Once Tried Always Used.

Price, $9.00 each, F. O. B. Columbus, Ohio.

Manufactured and Sold by

THE IDEAL FACE SHIELD COMPANY

468 N. Garfield Ave., Columbus, Ohio

Welders Attention!

Burning Up Are You?
And Your Torch Backfiring Every Two Minutes.
Heavy Jobs A————

Send For A MECO, Work in Comfort and Continuously

MECO

Modern Engineering Co.

General Office and Factory

23rd and Walnut Sts., ST. LOUIS, U. S. A.

EYE PROTECTION.

(Continued from page 46.)

in addition to his own glasses should have any bad effects either due to the ultra violet light, which is cut out by your goggles, or due to his own error in his eyes, for that has been corrected by proper lenses. Of course if the goggles are used they should be so constructed that any extraneous light cannot enter at the sides, since the sudden change in intensity would undoubtedly strain the eyes, just as our eyes are strained if we look directly into the sun.

If the above mentioned precautions are taken, I do not see why the person should be injured. But to prove this point, experiments would have to be made."

The goggles referred to are the product of the Chicago Eye Shield Co.

FUTURE BUSINESS.

In an address before the Newark Sales Convention of the Oxweld Acetylene Co., Mr. Harry L. Tyler, of Murray Howe & Co., Advertising Counsel for the Oxweld Co., had this to say, in part:

"We see that while American business was temporarily varied by the war, we were not—after all—in the war far enough nor long enough to be changed by it.

"We see that—despite the war—human nature in America is still about as human and natural as it ever was; we're continuing the nefarious practice of buying and selling on the old original plan; and we're going to do it quicker and more of it in the same old way in the golden years before us.

"We see that no time is more modern than the present; no up-to-dateness can be so all-fired smart as to extend beyond the now; the successful salesman of 1914 is the best salesman in America today, and the very methods with which he succeeded in 1914 will carry American business to triumphant victory now in whatever part of America the American salesman may operate. * * *

"In the selling of oxwelding and cutting equipment, advertising is by no means the whole thing; but it's one of the important things. It's the jazz band of the party."

Mr. S. V. James has succeeded Mr. J. I. Banash with the Underwriters Laboratories, Chicago. Mr. James will have charge of testing Oxy-Acetylene apparatus. Mr. Banash has entered the service of the Oxweld Company.

The International Oxygen Company announces the removal of its general offices from 115 Broadway, New York, to the company's Waverly Works at 796 Frelinghuysen Ave, Newark, New Jersey. This centralization of the executive, sales and production departments at one point is made, in order better to serve the interests of the company's trade.

The annual meeting of the Gas Products Association will be held at the Annex Hotel, Chicago, Jan. 17th.

REGO CIRCULARS.

The Bastian-Blessing Co. has recently issued three circulars describing and illustrating Rego welding and cutting equipment, lead burning outfits, etc. One of the circulars is entitled "Real Tests for Flashbacks" and illustrates a very severe trial to which Rego torches are put. A preheating flame is played on the head of the torch until the tip, nut, mixing chamber and head are red hot.

NEW CUTTING MANUAL.

The General Welding & Equipment Co., 107 Mass. Avenue, Boston, Mass., has published a new edition of their cutting manual. The manual contains a great deal of valuable information and useful tables, also illustrations of unusual and remarkable cutting jobs.

MUST NOT REFILL TANKS.

The Wichita (Kans.) Beacon publishes the following:

"Judge Pollock has sustained the finding of Special Master C. H. Brooks in the case of Earnest Craig, enjoined by the Prest-O-Lite Company from filling their tanks without removing the name wherever it appears.

This is the first case of its kind to come up in Kansas, according to the belief of Earle Evans, attorney for the Prest-O-Lite Company, and considerable interest was aroused in legal circles.

Craig filed exceptions to Brooks' ruling and the case was heard by Judge Pollock at Kansas City. He found the defendant guilty of contempt of court and fined him $1,000 and costs."

Mr. Craig is the head of the Headlight Gas Co. This practice has in the past resulted in much damage and loss of life.

Classified Ads

Help Wanted—25c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—50c per line, minimum 4 lines.
Count 8 words to line. Add 6 words for keyed address.

Wanted—Salesman to solicit subscriptions to *The Welding Engineer*, or furnish names of possible readers. Compensation good. Correspondence confidential. Write Mackenzie.

Position Wanted—Welder with 6½ exp. on all metal and all classes of work wants position as salesman or instructor for some reliable acetylene welding equipment company. R. Michels, 10 Linden St., Elmwood Place, Ohio.

Job Wanted: Expert electric arc and oxy-acetylene welder; 10 years' general experience; 4 years as foreman. Address B. C., care *The Welding Engineer*.

Job Wanted: Welder with 7 years' general experience; all metals; single; supports mother; must have $6 for 8 hours. E. A. Johnson, 1840 North Ballou Street, Chicago.

Wanted: Salesmen of ability to solicit orders for oxygen and hydrogen; should be able to demonstrate when necessary; must be a man of good habits and character; good salary. Address Oxygen Salesman, care *The Welding Engineer*. 1t Jan.

SALES MANAGER.

TO A MAN WHO HAS A THOROUGH KNOWLEDGE OF SPECIFIC CONSUMERS OF AND MARKETS FOR WELDING SUPPLIES FOR OXY-ACETYLENE AND ELECTRIC WELDING WE OFFER THE OPPORTUNITY OF DEVELOPING A DEPARTMENT ALREADY CREATED UPON A SALARY AND COMMISSION BASIS. CONCERN IN NEW YORK CITY. ADDRESS N. Y., CARE THE WELDING ENGINEER. 1-t Jan.

There's Profit in a Good Welding Outfit

The better the tool, the better the work.
The better the work, the greater the demand for it.
The greater the demand, the more volume and the more profit.

VULCAN

Oxy-Acetylene Cutting and Welding Outfit

is the most efficient. No job too big or too small. No outfit is so economical, so reliable—it cannot be surpassed.

A Vulcan Outfit will be highly profitable for you. But be sure you get a Vulcan.

Send for full information. Ask for catalog W-1.

Air Reduction Sales Co.

2445 University Ave., S. E.

Minneapolis, Minn., U. S. A.

Anti-Borax WELDING FLUX

Anti-Borax Welding Fluxes

Our Brazing and Welding Fluxes for Cast Iron, Brass, Aluminum and other metals are superior to any other. We guarantee them to give perfect satisfaction.

For sale by all jobbers or by

Anti-Borax Compound Co.
Fort Wayne, Indiana

IMPERIAL
WELDING CUTTING EQUIPMENT

You can't afford to use less than the best facilities in your repair work. Imperial Welding and Cutting Equipment is first in Safety, Speed, Economy and Efficiency. Its maintenance cost is low because of the small gas consumption, and a single operation often pays for its cost.

We are headquarters for Welding, Cutting, Carbon Burning and Lead Burning Equipment and Supplies of all kinds and ship on short notice. Write for the Imperial Catalog and full, detailed information regarding methods of operation, economies effected, etc.

IMPERIAL BRASS MFG. CO.
522 S. Racine Avenue CHICAGO, ILL.

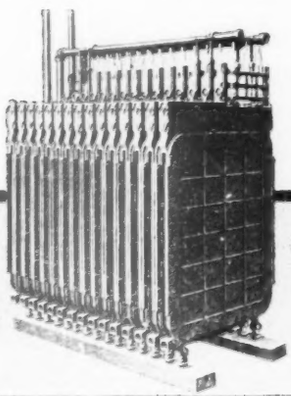
Large rope drive pulley broken in seven pieces. Welded with Imperial Equipment.

OXYHYDROGEN
QUINTESSENCE OF PURITY
For Cutting, Welding, Hydrogenation

Delays in delivery of cylinder gases may cost you losses in production in one year which would go far toward paying for an I. O. C. Unit Oxyhydrogen Generator of your own. And I. O. C. pure gases bring you the further great advantage of a big increase in volume of work per cubic foot of gas used. Ask us for concrete figures.

"The Cell With Three Times the Capacity per Unit of Space"

International Oxygen Company
115 Broadway NEW YORK



I.O.C. SYSTEM

Aluminum Flux

The "Lawrence" Aluminum Flux is the only flux suitable for both sheet and cast aluminum.
Used by most body builders and aluminum foundries in their salvage work.
WELDERS: *You will have no trouble in welding aluminum. A trial order will surprise you.*
L. LAWRENCE & CO. (Est. 1862) **1240-50 E. Jefferson Ave., Detroit, Mich.**

Messer

Welding and Cutting Apparatus

Injector Type

MESSER MFG. CO.

121 N. Seventh St., PHILADELPHIA, PA.

"Morey" Aluminum Flux

+ + +

Let old habits die with the dying year
And use our product the new year,
For to be on the square I simply declare
You can't find its beat anywhere.

+ +

Morey Flu x and Chemical Company
Parkersburg, Chester County, Penn., U. S. A.

"WHEN YOU THINK OF WELDING YOU THINK OF THE SUPERIOR"

Welding and Cutting Outfits. Acetylene Generators

Torches (welding and cutting).
Regulators and gauges.
Superior Cutting Torches have been approved by the Underwriters.

Cast iron rods	WIRE	Vanadium
Aluminum rods		Nickel
Aluminum solder		Norway
Manganese rods		Swede
Tobin Bronze rods		Armco
Brazing wire	Fluxes (all kinds)	
Brass spelter	Hose (plain and armored)	

Write for our catalogue and monthly price sheet.
Agents Wanted.

Superior Oxy-Acetylene Machine Company
Hamilton, Ohio

Popular Prices *Service Immediate* *Quality SUPERIOR*

WELDING CARBON SPECIALTIES

Carbon Electrodes **Carbon Paste**

Carbon Rods and Plates

and Carbon Specialties of All Kinds

If it's carbon, we make it

NATIONAL CARBON COMPANY, Inc.
Cleveland, Ohio

SALESMEN and other employes of apparatus and gas manufacturers are wanted by the Welding Engineer to interest their customers in this paper.

LIBERAL COMMISSION

L. B. MACKENZIE
608 S. Dearborn St. CHICAGO

The Latest Book on Welding

Oxy-Acetylene Welding and Cutting

182 Pages Fully Illustrated
Price, Postpaid, 50 Cents

CONTENTS

Chapter 1, Acetylene. Chapter 2, Oxygen. Chapter 3, Welding and Cutting Torch. Chapter 4, Apparatus and Installation. Chapter 5, Preparing for Welding. Chapter 6, Welding of Different Metals. Chapter 7, Welding of Sheet Metal and Pipe. Chapter 8, Welding of Various Parts.

By P. F. WILLIS

Written by one of the oldest and most progressive authorit.es on the subject of welding. An up-to-the-minute text book, written for the purpose of giving the welder the greatest amount of information for the least possible cost. The second edition is now ready. Price, 50 cents.

P. F. WILLIS, 2305 N. Eleventh St., St. Louis, Mo.

Bermo Welding Plants

OXY-ACETYLENE

13 years successful record

Guaranteed. Write for Catalog and Easy Terms

$25 to $250

Bermo Supply Co., Omaha, Neb.

Oxy Acetylene **U.S.** Welding Apparatus

Cutting and Decarbonizing Apparatus
Parts and Supplies

UNITED STATES WELDING CO., Minneapolis, Minn.

CALCIUM CARBIDE

OXYGEN

NITROGEN

WELDING SUPPLIES

ACETYLENE GENERATORS

ACETYLENE

WELDING AND CUTTING APPARATUS

THE AIRCO PROCESS

OF OXY-ACETYLENE WELDING AND CUTTING

IS THE KEY TO

INDUSTRIAL RECONSTRUCTION

Extract from the
BALTIMORE & OHIO EMPLOYES MAGAZINE, October, 1918
Relating to the Airco Service and Process

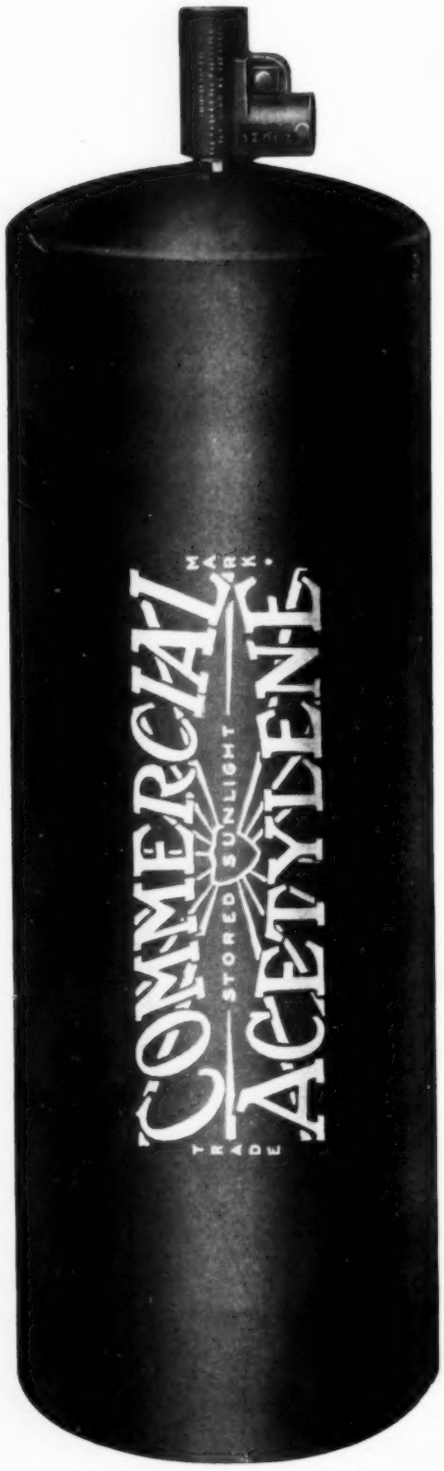
"A new feature has been added to the varied output of our shop, that of building up worn frogs by welding new material in the worn surfaces. An expert is teaching three operators and after they have become efficient they will be sent out over the system repairing frogs in the track. A special filler rod is used and after the frog has been resurfaced it will give much additional service. This process has been successfully tried out on other roads, where such frogs have given good results. The saving is large."

AIR REDUCTION COMPANY, INC.

120 BROADWAY, NEW YORK

DISTRICT OFFICES

ATLANTA, GA., 558 MARIETTA ST.
BALTIMORE, MD., 546 E. MONUMENT ST.
SO. BOSTON, MASS., 365 DORCHESTER AVE.
BUFFALO, N. Y., 790 GRANT ST.
CHICAGO, ILL., 2236 SO. LUMBER ST.
CINCINNATI, OHIO, 40 VINE ST.
CLEVELAND, OHIO, 1210 W. 69TH ST.
DALLAS, TEXAS, 823 SO. LAMAR ST.
DEFIANCE, OHIO, SQUIRE AVE.
SAN FRANCISCO, CAL., 179 FIRST ST.
DISTRICT OFFICE: EMERYVILLE, CAL., PARK AVE. AND HALLECK ST.
DETROIT, MICH., 1813 HARTWICK ST.
KANSAS CITY, MO., 1535 COOKSON AVE.
MINNEAPOLIS, MINN., 2429 UNIVERSITY AVE.
NEW YORK CITY, 280 BROADWAY.
PHILADELPHIA, PA., GERMANTOWN AND ALLEGHENY AVENUES.
PITTSBURGH, PA., 2515 LIBERTY AVE.
ST. LOUIS, MO., 115 PLUM ST.
SEATTLE, WASH., 3623 E. MARGINAL WAY.
SO. BETHLEHEM, PA.
RICHMOND, VA., c/o RICHMOND TERMINAL WAREHOUSE.
OKLAHOMA CITY, OKLA., P. O. BOX 1338, STOCK YARDS STATION.



Commercial Acetylene

Carried in portable cylinders in the following sizes:

10" x 30" containing 125 cu. ft.
12" x 36" containing 225 cu. ft.
12" x 44" containing 275 cu. ft.

We do not require responsible parties to purchase or pay a deposit on acetylene cylinders.

Commercial Acetylene is absolutely pure and guaranteed to make a good weld. It is uniform in quality and dependable.

Commercial Acetylene Supply Co.

Main Office: 80 Broadway, New York City
208 S. La Salle Street, Chicago

Atlanta, Ga. Aurora, Ill. Boston, Mass. Bound Brook, N. J. East Deerfield, Mass.
Toronto, Ont. San Francisco, Cal. Moberly, Mo. W. Berkeley, Cal.